A context-based methodology for integrating Web 2.0 services in learning scenarios

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Abstract: The emergence of the Web 2.0 technologies in the last years have changed the way people interact with knowledge. Services for cooperation and collaboration have placed the user in the centre of a new knowledge building space. The development of new second generation learning environments can benefit from the potential of these Web 2.0 services when applied to an educational context. We propose a methodology for designing learning environments that relates Web 2.0 services with the functional requirements of these environments. In particular, we concentrate on the design of the KRSM system to discuss the components of this methodology and its application.

Keywords: Web 2.0 services; knowledge resource system management; KRSM; activity context; AC; knowledge resource; KR.

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1 Introduction

The web has now become a user-centred platform for managing and manipulating information. The newly emerging tools and services that allow users to create and share their own resources have changed the way that people interact and generated a new space for knowledge building based on users' collaboration and cooperation (Anderson, 2007; O'Reilly, 2005). Some studies propose methodologies and mechanisms to introduce several Web 2.0 services into education to enhance collaboration and facilitate content generation (Ebner and Palmér, 2008; Vuorikari, 2008; Asensio-Perez et al., 2008; The New Media Consortium and the EDUCAUSE Learning Initiative, 2007; Sharma and Barret, 2008). This diversity makes the conceptualisation of a common integrated Web 2.0 platform covering the learner's necessities a complex task. In the framework of the TENCompetence European Project (http://www.tencompetence.org) a knowledge resource system management (KRSM) is proposed as an accessible space for creating,

discovering and sharing resources adapted to the learner's needs (Marenzi et al., 2008). The KRSM defines a set of functional requirements that reflect these needs. It also specifies a set of usage activities by which the learners manipulate different knowledge resources (Koper et al., 2008).

The motivation behind this work is to select and adopt adequate Web 2.0 services that can be integrated into one platform that satisfies the KRSM functional requirements and supports its activities. In order to accomplish this task, we need an abstract interaction schema that defines the system components and their related functionalities. In addition, we require a selection mechanism that incorporates an evaluation criterion for assessing Web 2.0 services in order to identify the most adequate subset of services from the available pool.

This article is structured as follows. In Section 2 we describe the methodology followed throughout this article. Next we identify and refine the KRSM interaction schema in Section 3. Section 4 describes a Web 2.0 services' selection criteria and a proposal for its application. Finally, the main conclusions and future work are included in Section 5.

2 System design methodology

We model the KRSM's interaction schema with abstractions that support a methodological evaluation of existing Web 2.0 services. We designate three different types of abstractions: activity context (AC), activity, and knowledge resource (KR). A context is prominent notion that surfaces across different academic domains, from psychology and cognitive science to HCI and system engineering. Akaishi et al. (2003) define it as a modular representation of information under different perspectives in their description of a framework for context-based generation of information access spaces. Same notion is repeated in the work of Theodorakis et al. (2002) who define context as a cognitive container which encapsulates a particular information view. From an interaction design perspective, one context corresponds to one generic usage objective and encapsulates the interactive functionalities that correspond to this particular objective. These functionalities are articulated in the form of a series of activities, each defining a particular generic user action such as bookmarking or searching. Every context houses one or more information elements that the user manipulates by executing activities. The set of information treated in each context can represent one or more type of information elements such as videos, articles or blog posts (Richards et al., 2002). We call these objects KRs.

The KRSM system serves several objectives dedicated to satisfying three major pedagogical needs: knowledge mining, transfer and personalisation. We hence intuitively define three ACs, each dedicated to serving one pedagogical need and then divide the related functional requirements between these contexts. The resulting diagram presents an interaction schema that serves as the main reference in evaluating the relevance of each candidate Web 2.0 service. The functional requirements are traduced into activities, each added to its relevant AC. The KRs are then integrated into the schema, which is finally evaluated by tracing the action sequences of the KRSM use cases.

3 Identifying and refining the KRSM' AC

We perform an analysis of the user educational needs in the KRSM scenario and derive a set of activities required to address them. On the other hand, the KRSM functional requirements are described through a set of activities referenced by 'scenario activities' in the context of the TENCompetence project (Koper et al., 2008). In order to assess the compatibility of different collections of Web 2.0 services with these functional requirements, we infer a set of generic activities from a large group of previously indexed Web 2.0 service (Moghnied et al., 2008) and compare them to these 'scenario activities'. In total, ten activities have been identified (see Table 1). We call them primitive activities since they are generically supported by Web 2.0 services.

Table 1 Relating the domains' activities with the primitive activities obtained

Scenario activities	*Primitive activities*	*Description of a situation*
Search resources	Search/find/explore	Search for familiar or new resources.
Explore categories	Filter/sort	User filters to sort available resources.
Publish	Publish/upload/share	Upload personalised resources to public system.
Bookmark	Bookmark	Guard a reference to a specific resource of interest.
Edit resource	Edit/write/create	Create a new resource or edit an existing one.
Rate resource	Rate	Associate an evaluative scaled rating to a given resource.
Add tag	Tag	Label a resource with a representative concept(s).
Comment resource	Comment	Add comments to a resource.
Download	Download	Guard interesting resources locally.
Search per tags	Filter per tags	Use inherent tags to sort resources.

Next, we cluster the activities described in Table 1 in three different ACs. We analyse the nature of each activity and group them according to the learner's usage objectives when performing them. For example, when a user downloads an image (download), he first has to search for it in a specialised image browser (search), select and sort the image provided by the browser and choose one (filter). Filter, search and download are activities that a learner performs treating amounts of KR with a unique intention and in the same context: the knowledge mining AC. We repeat the same process with the rest of the activities and obtain two more clusters: the knowledge transfer, related with activities that contribute to the expansion of the collections of resources, and the knowledge personalisation, that encompasses the activities that the user performs in order to organise and sort collected resources. Figure 1, shows the relation between the primitive activities and each of the AC.

Table 1 relates the primitive activities to the scenario activities of the KRMS system. The result is an initial schema with three ACs, where the learner manipulates different KRs through the primitive activities determined by the usage objective (see Figure 2). We aim to provide the user with an environment in which passing through an activity and from one activity to another should be a natural process. For this, we refine the first schema iteratively until having a model that avoids the overlaps over the different ACs.

When the actions of the learner described in the usage profiles in Koper et al. (2008) are traced over the schema, some overlaps between these ACs are revealed. Hence, after iterating the schema and refining it we obtain three independent ACs (Figure 3) that enclose a set of primitive activities that corresponds to the actions associated with each of the specific educational needs described in KRMS.

Figure 1 Mapping the educational domains behind KRSM to the primitive activities in Web 2.0 services (see online version for colours)

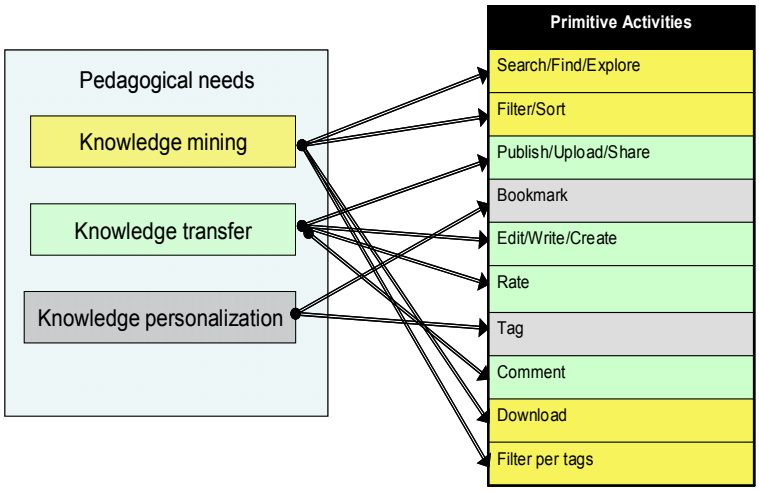


Figure 2 Initial schema with three ACs and their primitive activities determined by the usage context (see online version for colours)

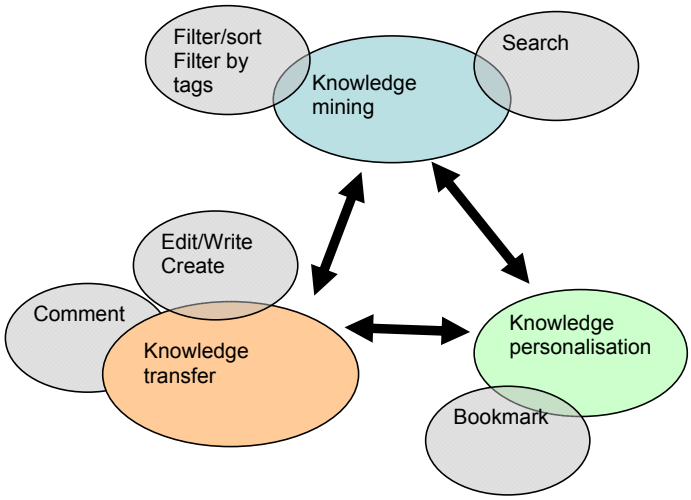
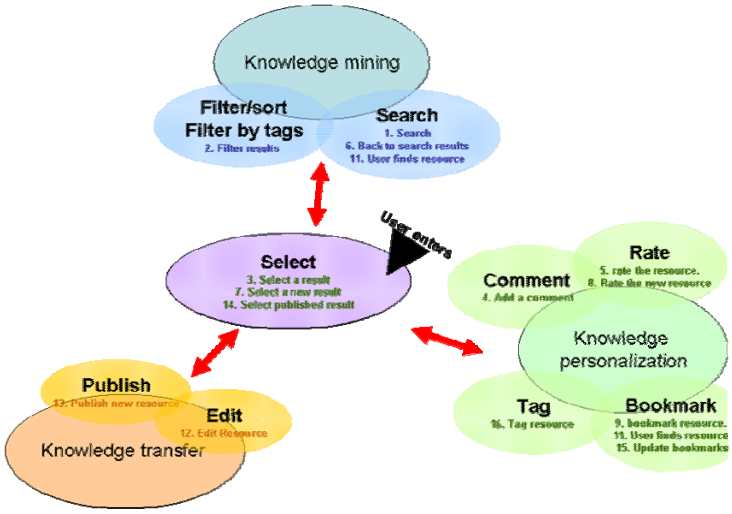


Figure 3 Final interaction schema (see online version for colours)



4 Drawing a selection criterion

A list of Web 2.0 services with potential compatibility with the KRSM's functional requirements has been previously drawn (Demidova et al., 2007). In order to choose the right bundle of services from this list, we rely on contrasting these services against the KRSM model formed by the three ACs identified, along with their associated primitive activities. This association between the primitive activities and the usage objective allows us to determine the type of resources that are manipulated in each AC.

Since most of the Web 2.0 tools are potentially related to the KRSM scenario, it becomes necessary to develop a selection mechanism that orders the services at hand according to their compatibility with the KRSM's model. First, the list is filtered according to a set of conditions based on Nielsen (2008) and Tognazzini's (1992) best practises for system design. These conditions are the following:

1 all services having functionalities that prove as incompatible with the design of the ACs and their schema should be disregarded

2 a service is selected if its functionalities cover the maximum number of primitive activities inherent in a specific AC

3 a service is selected if it handles all the types of KRs treated in this same context

4 the set of Web 2.0 services selected for a given context should be minimised.

Second, we propose a set of selection steps for choosing those Web 2.0 tools that offer the best fit with the pedagogical needs represented by the KRSM scenario. Since the KRSM should provide a way to manage KRs using existing Web 2.0 services, we can either:

1 look for a Web 2.0 service for managing a concrete type of KR

2 look for one that offers functionalities to treat a specific set of primitive activities.

We propose two ways of applying a selection criterion:

- activity-centred criterion:
  1 the service has to offer the functionalities to cover the selected primitive activity
  2 the best service would be the one that covers the maximum number of KRs for the selected primitive activity
  3 follow steps 1 and 2 till you reach the constraint, thus, having all the primitive activities covered.
- KR-centred criterion:
  1 the service has to cover the maximum number of technical requirements of the selected KR
  2 the service would be the one that covers the maximum number of scenario activities which treat the selected KR
  3 follow steps 1 and 2 till you reach the constraint, thus, having all the technical requirements covered.

For example, imagine a situation in which we have to select from a list of services (Table 2) the combination of tools that best cover the KRSM functional requirements. For this, the available services have been analysed and compared by mapping the functionalities with the primitive activities of each knowledge context that they cover. After this, we applied the activity selection criterion previously discussed. In this case, two services (Delicious and Drupal) represent the smallest set of services that covers all the functional requirements of the required system and treats all the inherent KRs types.

Table 2 Table of Web 2.0 tools and KRs applying the list of conditions

Services	*Knowledge mining*		*Knowledge transfer*		*Knowledge personalisation*			
	Filter/sort	*Search*	*Publish*	*Edit*	*Rate*	*Comment*	*Tag*	*Bookmark*
GroupMe		X					X	X
Flickr	X	X	X			X	X	
Delicious	X	X			X	X	X	X
Drupal	X	X	X	X	X	X	X	
Youtube	X	X	X		X	X	X	
Diigo						X	X	X

5 Conclusions and discussion

In this article we have discussed a methodology for context-based modelling of learning environments and the composition of such environments from proper selections of Web 2.0 services. A methodology was applied to KRSM, which was modelled in accordance with the primitive activities inherent to its functional requirements and the types of KRs treated. The identification of ACs helps in defining system components that

can be mapped onto existing Web 2.0 services. This methodology allowed the rapid conceptualisation and integration of a KRSM system called LearnWeb2.0. Our methodology is a preliminary approach that requires further testing and evaluation for its application in other scenarios. In the near future the methodology will be applied in other scenarios and evaluated accordingly. This includes the evaluation of the LearnWeb2.0 tool with real users that should conclude on the efficiency of composing learning systems from Web 2.0 services according to the methodology presented in this article.

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