Supporting learning analytics for informal workplace learning with a social semantic infrastructure

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Abstract. This paper presents the potential of a social semantic infrastructure that implements an Actor Artifact Network (AAN) with the final goal of supporting learning analytics at the workplace. Two applications were built on top of such infrastructure and make use of the emerging relations of such a AAN. A preliminary evaluation shows that an AAN can be created out of the usage of both applications, thus opening the possibility to implement learning analytics at the workplace.

1 Introduction

Informal learning at the workplace is a multi-episodic activity that is often connected to current demands and tasks at the workplace. This fact makes the knowledge to be easily applicable but hinders individual learning experiences to be further taken up in systematic organizational learning practices [1]. Supporting such unplannable learning experiences with technology has proven to be a major challenge that is far from being solved.

The Learning Layers project is devoted to tackle with these informal learning processes. Several applications have been developed in this project, as well as an infrastructure that enables their technical integration [2]. This infrastructure relies on a semantically-enriched Artifact-Actor Network (AAN) [3] that combines the social-network (e.g. Facebook) and the artifact-network (e.g. Wikipedia) approaches to describe the relationships among actors and artifacts in different learning contexts. The data related to the AAN can potentially be useful to further support learning activities or to monitor the learning processes [2]. But how to take advantage of this AAN to monitor and to feed back on these learning processes is still a problem that could be approached using learning analytics techniques [4]. This paper reports a first step exploring how an AAN can be exploited for learning analytics using a social-semantic infrastructure.

2 A social semantic infrastructure to support workplace learning

The Social Semantic Server (SSS) is an infrastructure specially developed to integrate workplace-learning applications. From a data perspective, its key idea

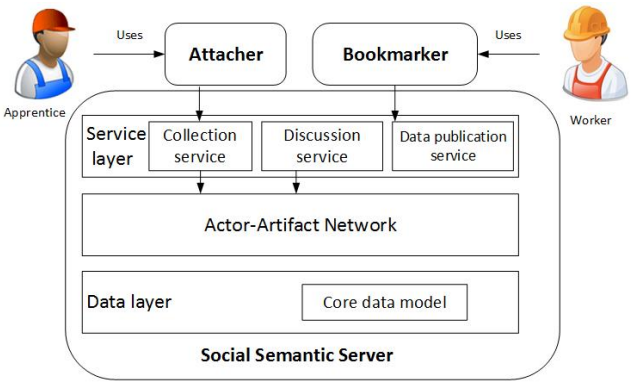

Fig. 1. Integration of learning applications into the social semantic infrastructure.

is to log the interactions between actors and artifacts -including some meta-data that describes the context where this interaction takes place- and then offer an abstraction of this data as a semantically-enriched AAN. Thus, the relationships between the SSS entities are explicit. In addition, as the relationships of this AAN have a semantic meaning, they can be based on different characteristics of the entities that may depend on their associated context. For example, some artifacts may be related because they are frequently accessed from the same place (a contextual characteristic) while two actors may be related because they chatted together or one read a document published by other.

Besides, it is not possible to foresee all the possible applications that can potentially be integrated into this infrastructure. For this reason we developed the SSS as a framework that implements an AAN via the provision and respective usage of a set of core services, such as tagging and discussion activities or users and artifacts recommendations [2]. These services can then be extended to satisfy the requirements of the applications integrated. Additionally, purpose-specific services can also be developed for some applications that require some extra functionality. Figure 1 graphically depicts the integration of learning applications into the SSS.

3 Attacher and Bookmarker

One of the applications that make use of the SSS is **Bookmarker**. It is a Chrome extension that simply allows users to submit bookmarks to the SSS while browsing. Each bookmark may include a title and a set of tags that describe it. Another application is **Attacher**, a WordPress plugin that integrates a blog editor to the SSS. Attacher displays a tagcloud in the blog publishing interface that includes the tags registered in the SSS. With this tagcloud the blog publisher can browse the artifacts published in the SSS, filter them by their authorship and easily cite them in the blog post using a drag-and-drop interface. In turn, Attacher

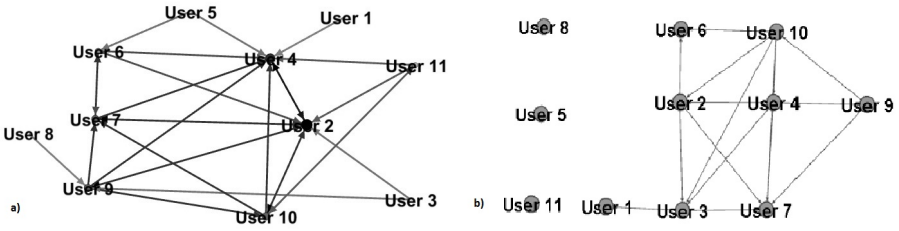

Fig. 2. Social networks of the students who browsed tags created by other students (left) and the students who used same tags to describe resources (right).

automatically registers the published blog posts in the infrastructure, including some additional meta-data to capture the context of the creation (authorship, publication time and tags related).

There was no need to extend the services available on the SSS to develop Attacher and Bookmarker. In this sense, these applications exemplify how well-known and massively used applications, as WordPress and Chrome, can easily be integrated into the SSS and thus share information among them.

4 Experience using Attacher and Bookmarker

Attacher and Bookmarker have been used in a master course for training future teachers at Tallinn University with one teacher and 10 students. Students were asked to bookmark web resources they considered relevant using Bookmarker. Then, they wrote a blog post about their reflections of the subject using WordPress and Attacher to browse the bookmarks published in the social semantic infrastructure.

The SSS registered the tags employed by the users (both to describe and browse them), the blog publications and their citations. These events were used to create a semantically-enriched AAN that had three different types of elements: actors, which represented the students; artifacts, which represented the blog posts and the bookmarks; and tags, which are meta-data related to the artifacts. The actors and artifacts could have several types of relationships. For example, there can be "assigned" or "used to browse" relationships between actors and tags. The resulting AAN had 11 actors, 53 resources and 116 tags.

Out of this AAN three social networks were extracted based on mediation artifacts, as suggested by the teacher: the students who cited a resourced bookmarked by other student; the students who used the same tags to describe resources; and the students who used to browse the tags assigned by other students. Only one student cited once a bookmark published by other student. The other two resulting social networks are represented in Figure 2. Several conclusions can be extracted analyzing these social networks. For example, in the left graph we can see that that some students influenced (e.g. user 2 or 9) their classmates more than others (e.g. user 5 or 9), since the tags they assigned to resources

were used later on for browsing by other students. The second network indicates that three students did not tag any resource using a tag that was also used by other student, which indicates that their topics of interest were not shared with the rest of the class.

5 Conclusions and future work

This paper presented a first step on how to support learning analytics at the workplace exploiting an AAN that was implemented by the SSS. The experiment done with students shows the technical viability of this approach and the SSS. It is also promising how the SSS can create semantically-enriched AAN. In this experiment the meta-data related to the artifacts was reduced to tags, but still three different social networks were extracted with different semantic relationships between the actors. These networks helped the teacher to analyze the learning of the students and to understand their behavior. This way it was exemplified how the SSS can integrate the data from different applications and coherently combine it to support learning analytics at the workplace. Further research is required to understand which of these contextual relationships are meaningful for the domain and how can they be exploited to explain learning processes at the workplace.

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References

1. Ley, T., Cook, J., Dennerlein, S., Kravcik, M., Kunzmann, C., Pata, K., Purma, J., Sandars, J., Santos, P., Schmidt, A., Al-Smadi, M., Trattner, C.: Scaling informal learning at the workplace: A model and four designs from a large-scale design-based research effort. British Journal of Educational Technology **45**(6) (2014) 1036 – 1048
2. Kowald, D., Dennerlein, S., Theiler, D., Walk, S., Trattner, C.: The social semantic server a framework to provide services on social semantic network data. In: Proceedings of the I-SEMANTICS 2013 Posters & Demonstrations Track co-located with 9th International Conference on Semantic Systems. Volume 1026., Graz, Austria, Citeseer (2013) 50–54
3. Reinhardt, W., Moi, M., Varlemann, T.: Artefact-Actor-Networks as tie between social networks and artefact networks. In: Proceedings of the 5th International Conference on Collaborative Computing: Networking, Applications and Worksharing, Washington, USA, IEEE (2009) 1–10
4. Duval, E.: Attention please!: Learning analytics for visualization and recommendation. In: Proceedings of the 1st International Conference on Learning Analytics and Knowledge (LAK), Banff, Canada, ACM (2011) 9 – 17