

Sharing of Community Practice through Semantics: A Case Study in Academic Writing

Vania Dimitrova¹, Lydia Lau¹, Alex Le Bek²

¹ School of Computing, University of Leeds, UK
{vania, llau}@comp.leeds.ac.uk

² Web Design: Simple solutions from advanced technology, Leeds, UK
alex@alexlebek.com

Abstract. This paper presents a process-driven design of a semantic wiki environment for academic writing, based on the pedagogy of social scaffolding. We illustrate how semantics can be exploited to facilitate effective sharing of practice during the main stages of dissertation writing. We also show initial exploration of semantics for community scaffolding. The research is being conducted within an interdisciplinary project involving pedagogical experts, user communities, and software developers.

Keywords: Semantic wikis, Community Support, Academic Writing Practice

1 Introduction

Recent developments in the Semantic Web (SW) are investigating the decentralised processes of collective intelligence, community-driven knowledge creation, and emergent semantics [1, 2, 7]. Semantic wikis, which combine both the flexibility of wiki-like dynamic content creation and the power of semantically-enriched content annotation and search, increasingly play an important role in the SW research [3, 10, 14]. Studies demonstrate advantages of semantic wikis for collaborative creation of scientific content (e.g. [12]) or for community ontology maintenance (e.g. [11, 16]). However, the exploitation of semantic wikis in educational settings is still in a premature phase; there are only a few initial explorations and a very limited number of use cases [6, 15].

The link between community-driven learning environments and semantic wikis is twofold. On the one hand, the integration of wikis, semantics and ontologies can enhance the learning experiences by facilitating the creation, structuring, and finding of learning content [15]. On the other hand, the educational domain brings new challenges that can inspire further research and developments in semantic wikis. Notably, learning occurs through *active engagement and sharing of practice in a community* [17]. Hence, the key difference between the ‘traditional’ knowledge management role of semantic wikis and their new role of being the core of *effective learning platforms* is the shift of focus from the result to the *process* [15]. We argue that this focus shift requires addressing two key aspects: (a) process-driven customisation of semantic wikis for learning; and (b) development of new features to provide intelligent support for both the sharing of practice and the functioning of the community. We investigate these aspects in our

research in a case study of Academic Writing (AW) – a persistent educational problem experienced in a wide range of subject domains, disciplines, and institutions.

The paper reports work in progress within the AWESOME (Academic Writing Empowered by Social Online Mediated Environments) project¹ which develops a community environment to support dissertation writing. We will first describe the academic writing problem and the challenges addressed by the AWESOME project (Section 2). Section 3 will give an overview of the AWESOME environment pointing at the key semantic features used. The following sections will discuss the support provided for the main stages of the AW process (section 4) and community forming, functioning and moderation (section 5). A discussion on several emerging perspectives will be provided in section 6. Finally, we will conclude and outline future research plans.

2 The Problem of Academic Writing

In Higher Education, academic writing is one of the skills that the students are assumed to have mastered to a certain level before joining their courses. Although different disciplines involve different extent of AW as part of their study, most will require their students to undertake a significant piece of independent work such as a dissertation in their final year. Hence, the AWESOME project has chosen dissertation writing as the domain of investigation, as it has the potential to *explore the generic versus specific issues across different disciplines*.

Writing a dissertation is an essential learning experience for most university students across different disciplines. A common model involves a student working independently but under the supervision of a faculty member over a period of 6 to 12 months. Due to the emphasis of ‘individuality’ and ‘independence’ in dissertation work, students tend to treat dissertation writing as a *lone journey* under the periodic guidance of a supervisor. Information/knowledge are provided by and collected from different sources, usually in different formats and formality (web pages and other printed material, special talks, discussions, chats along the corridor and so on). Picking up the right type of information at the appropriate time during the dissertation process is not always straight forward, as it can range from lack of information to information overload. Very often, a student requires *tailored advice* rather than ‘generic’ or ‘text book’ advice. There are obvious benefits to obtain this ‘tailored’ advice from a wider community, beyond the usual source of a supervisor.

Research has shown that students could enrich their learning by sharing ideas and experiences, and by talking through the issues with others in shaping their understanding of relevance. This is an example of *social scaffolding* [4]. Lueg [13] echoed that information needs are ‘dynamic phenomena’ and that “socially-determined relevance has not yet received the attention it deserves in information science and knowledge management”. AWESOME examines a novel approach to study the process of building

¹ AWESOME is an interdisciplinary project funded by JISC, UK. It involves partners from departments of Education, Computing, and Staff Development at the University of Leeds, as well as the Centre for Academic Writing at the University of Coventry, and the School of Lifelong Learning, at the University of Bangor.

an AW community of practice by customising a semantic wiki-based online social environment and by shaping the emerging common practice through its use.

Traditionally, higher education curricula focus on discipline-specific knowledge and the 'teaching' of AW is assumed unnecessary as students should have acquired the skills at schools. Many institutions have acknowledged this dilemma and have made central provision in supporting students who need further help, such as periodic workshops and web-based resources for self-study. Nevertheless, if one takes the viewpoint of an individual student, support provided by an institution, whether centrally or departmentally, can be plentiful in terms of information but may not necessarily be timed at the right stage as progress of individual dissertation varies. Specific queries which require answers urgently usually come to light when an individual student is working on a particular part of the dissertation, and are often difficult to anticipate in advance. Hence, AWESOME aims to provide the additional social scaffolding support through the use of a Web2.0-based social environment to integrate / augment the various sources of support for the individuals during their dissertation writing process.

3 The AWESOME Dissertation Environment²

The AWESOME environment follows Web 2.0 tenets for collective content creation and information sharing in an informal and organic way. It is being developed as an institutional demonstrator at Leeds University and is based on MediaWiki³ - the main wiki platform used at this university. The semantic extension for MediaWiki⁴ is used to create and query semantic content [10]. The semantic wiki environment is customised for the sharing of practice in an AW community including the following features:

- **Annotations** of content based on pre-defined categories and user-defined properties; annotations are used for finding the right information at the right time, as well as for helping with community moderation.
- **Semantic forms** for enhancing ease of use and structure; customised forms are used for asking questions and making comments to content.
- **Dynamic queries** to give semantic-enhanced view of the practice and community functioning.
- **Tag cloud and folksonomy** to provide a general outlook of the environment and to indicate popular topics.
- **Embedding of text, audio, and video** to enable sharing of dissertation experiences in a flexible way (e.g. podcasts with student/tutor reflections)
- **Community biblionomies and portals** to enable sharing of information resources and providing feedback on their applicability and credibility.
- **Blogs and Chat** to facilitate communication and sharing of experiences.

The current prototype is built following examples and electronic content from an existing course on dissertation writing at the School of Education, University of Leeds.

Semantics is added via a special markup in the main text of a wiki page. The underlying conceptual framework includes **categories** which correspond to core

² The current AWESOME environment is available from <http://awesome.alexlebek.co.uk/wiki/>

³ <http://www.mediawiki.org>

⁴ http://semantic-mediawiki.org/wiki/Semantic_MediaWiki

ontology concepts. Example of categories in AWESOME include `[category::is top tip]`, `[[category::dissertation]]`, `[[category::research method]]` and so on. The categories are organised in a hierarchy, interpreted as an OWL ontology. In the current AWESOME prototype, the main categories have been selected from a dissertation marking scheme and from core concepts pointed out by the pedagogical partners in AWESOME.

Properties express binary relationships between one semantic entity (a wiki page or a category) and another data entity or data value. Properties are page-centric definitions and enable augmenting a page with structural information. Users have full control over the definitions of properties and the values they assign. Example properties from a tutor's feedback on a past dissertation in the current AWESOME prototype include:

```
[[good writing::argument is generally clear]]
[[good writing::synthesise ideas and relate them to the topic]]
[[bad writing::images should not be added just for decoration]]
```

Each category or property can be connected to a wiki page with a description which can help users get more information and use them appropriately. Semantic annotations can be queried and displayed in a structured way. For example, part of the opening page of AWESOME summarises the main top tips for dissertations (see Fig 1). A factbox can be shown to give a summary of the usage of a category (Fig 1).

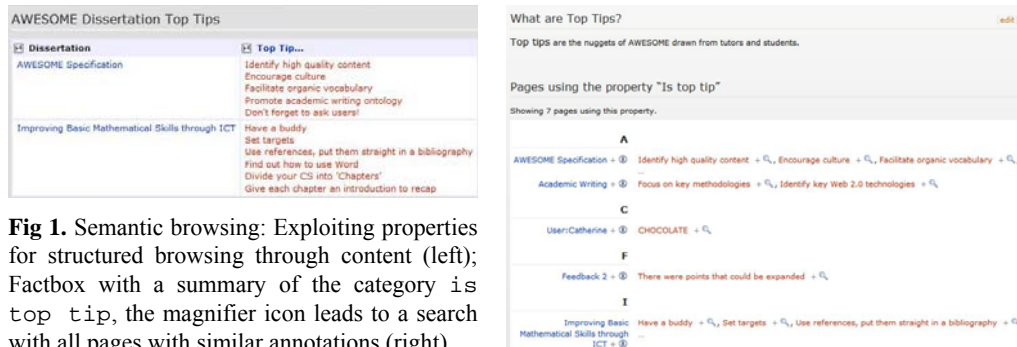


Fig 1. Semantic browsing: Exploiting properties for structured browsing through content (left); Factbox with a summary of the category `is top tip`, the magnifier icon leads to a search with all pages with similar annotations (right).

We will illustrate next how the semantic features are used to support both the AW process and the community forming/functioning process.

4 Semantically-enhanced Support for the AW Process

Developing a dissertation is more than just writing-up. A good dissertation requires a suitable topic with the right approach to tackling challenges. Intensive searching and periods of reflection usually take place in bursts which evolve around either the major official 'events' laid down by the department (e.g. submit dissertation plan) or the individual's progress in the dissertation process (e.g. what style of citation should one use in the writing-up stage). These activities (such as checking with peers that one's interpretation is correct, or asking for help in providing examples) are examples of social scaffolding. In AWESOME, a process-oriented framework is adapted for the scaffolding activities. It consists of several stages outlined below. Each stage has a dedicated wiki page that includes combination of text/video/audio with semantic annotations and forms.

What is a dissertation is the getting-started stage where the students obtain a general overview of the dissertation process. AWESOME exploits semantic forms for adding example dissertations and query-resulted tables to show main tips (Fig 2).

How to choose a topic is also a stage at the beginning of the dissertation writing process when the students have to select their dissertation topics. They need to examine what makes a good/bad dissertation topic, and what challenges may be associated with each topic. AWESOME exploits semantic forms to enable entering structured annotations about a topic, which can be examined by a factbox (Fig 2). In addition, query-based table is provided to extract top topic tips from the annotated content (Fig 2).

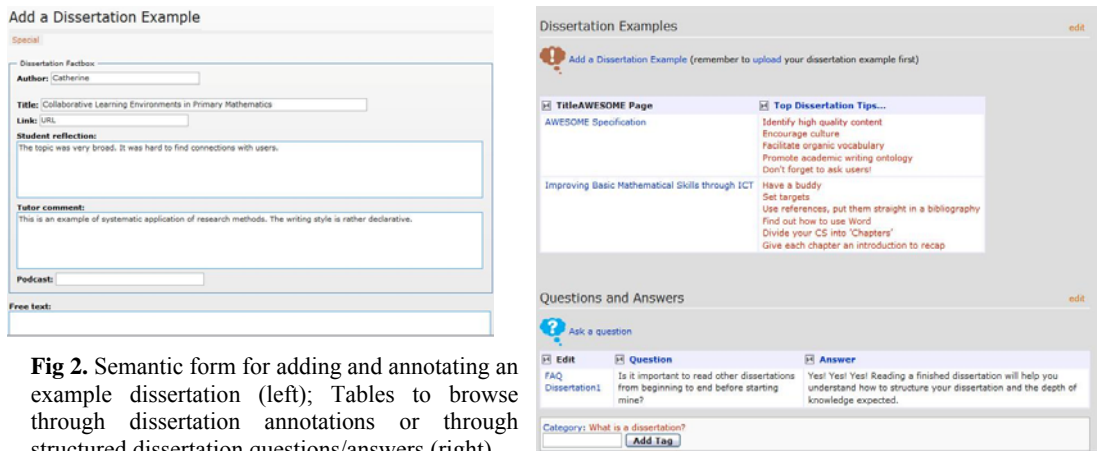


Fig 2. Semantic form for adding and annotating an example dissertation (left); Tables to browse through dissertation annotations or through structured dissertation questions/answers (right).

How to formulate research questions is the stage when the research process on the dissertation commences. The students usually ask questions about the research process (a structured question/answering semantic form is provided in AWESOME, similar to Fig 2 right), read about research methods and identify which ones are appropriate for their topic. In the current prototype, we have included a semantic form to upload a paper about a research method similarly to the example in Fig 2 (left). We also exploit the factbox summaries, similarly to the topic summary shown in Fig 3 (left), to enable quick access to all content related to a particular research method.

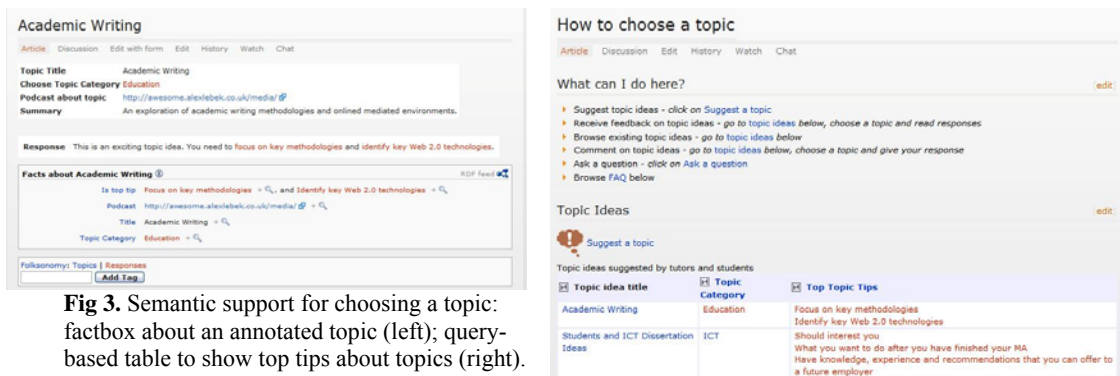


Fig 3. Semantic support for choosing a topic: factbox about an annotated topic (left); query-based table to show top tips about topics (right).

How to investigate a problem is closely connected to the previous stage (in fact, it is based on identifying the appropriate research methods for the research topic and questions). Hence, most of the related content can be found from accessing the wiki page dedicated to the previous stage. We are also considering adding a link to an external mind mapping tool, which can be helpful for structuring the research process. In the current version, we consider only sharing of mind mapping images with additional annotations about the research process. The added annotations would enable further analysis of similarities across patterns of research processes undertaken by students.

How to find appropriate resources is an inevitable part of researching a problem. Because of its importance, the AWESOME pedagogical experts have advised us to consider it as a separate stage and to dedicate a structured wiki page to it. We have currently included a semantic form for adding a bibliography link (e.g. ACM digital library) or a bibsonomy. The students can use semantic annotations to comment on the relevance and credibility of the sources.

How to communicate ideas clearly is a core stage in the dissertation writing process, which is usually a major challenge to all students. Although general guidelines, such as ‘write argumentatively’, ‘follow a coherent structure’, etc., are provided, many students struggle to understand what these guidelines mean and to apply them in practice. AW pedagogical experts have advised us that students should be able to find examples of good/bad writing, share writing tips and writing experience. In the current prototype, we have included both free text annotations with properties related to good/bad writing, structure, analysis, etc. (Fig 4), and structured semantic forms to examine feedback and to follow links describing the properties from the annotated content (Fig 4).

The figure consists of two side-by-side screenshots from the AWESOME prototype. The left screenshot, titled 'Editing Feedback 1', shows a text editor interface with various semantic annotations embedded in the text. These annotations include properties like 'is coverage::identify key issues', 'is analysis::understand key ideas and relate them to experience and to the topic', and 'is presentation::observed the length requirement'. The right screenshot, titled 'Writing Up Feedback Examples', shows a form for adding feedback examples. It includes a table with columns for 'Feedback page', 'Exemplifies good writing in these areas', and 'Feedback 1'. The table contains two rows of feedback examples. Below the table is a 'Questions and Answers' section with a table for questions and answers, and an 'Add Tag' button.

Fig 4. Semantic annotations to point at good/bad writing examples (left) and a form for easy access to feedback examples (right).

The current version of the AWESOME prototype exploits solely existing features in Semantic MediaWiki. This lays the foundation for supporting the AW process. The addition of semantics appears beneficial for telling us more about a user’s interaction with content. In the follow-up development, we intend to exploit the semantic annotations to derive user profiles (e.g. by examining the properties contributed by a user, the categories a user is interested in, and the stages of the academic writing process

the user goes through). Our ultimate vision is to be able to provide *intelligent assistants* that can offer advice tailored to the needs and current tasks of each individual student.

5 Semantically-enhanced Support for Community Processes

An online community goes through the major stages of forming, functioning, and finishing [8]. Effective technology should provide appropriate support for the mediation of these stages. Based on the existing features in Semantic MediaWiki, we have been able to provide some support for community functioning.

Forming of a community is the first stage in a community when individual members have to be enticed and shown that their needs will be met by this community [8]. We have used semantics to provide a general overview of the community, including current dissertation tips (Fig 1), folksonomy (based on tags assigned to pages), AWESOME culture (based on feeling-related top tips provided by users), and AWESOME press (summary of the current activities in the community), see Fig 5.

The screenshot displays the 'The AWESOME Press' interface. On the left is a sidebar with a list of navigation links including Authors, Bibsonomies, Chocolate Culture, Dissertation FAQ, Dissertations, FAQ, FindResources, Greetings, HowToInvestigate FAQ, How to investigate a problem, Investigations, Mind, Mapping, Research, Method Resources, Research Methods, Resource Portal, Opinions, Resource Portals, Responses, Topic, Categories, Topic, FAQ, Topics, What is a dissertation?, WritingUpFeedback, and WritingUpFeedback FAQ. The main content area is titled 'The AWESOME Press' and contains three columns: 'Newly Posted Articles', 'New Blog Articles', and 'Most Popular Articles'. Below these columns is a table titled 'AWESOME Culture Top Tips' with three columns: 'AWESOME Contributor', 'Top Tip...', and 'Feeling...'. The table lists Catherine and Peter as contributors, with tips like 'CHOCOLATE' and 'BE COMFY', and feelings like 'HAPPY' and 'TEPID'.

Fig 5. Use of semantics to present a general overview of the community: Folksonomy (left), summary of community activities in AWESOME Press (top right), AWESOME culture (bottom right).

Furthermore, support with the planning of activities and structuring of information is critical. Crucial at this stage is the establishment of *shared mental models* and a *transactive memory system*, for which new features can be added to the environment. For example, community modelling algorithms [9] can be adapted to discover semantic relationships between users by analysing the properties and categories visited.

Functioning is the next stage a community goes through. This requires support for *bonding* - desire to stick together and actively engage in the community [8]. The overview provided in the current prototype can be useful not just for forming but also for facilitating the effective moderation and functioning of a community. We expect that further support for community moderation would be required and semantics can be beneficial for this. Crucial for the effective functioning of a community is to be able to address *diverse needs and expectations* of its members. We believe that semantics can

provide the basis for discovering diverse needs and providing adaptive support, as commented above. The *learning process* can be analysed by examining the evolution of patterns for functioning of a community and the contributions of each member.

Finishing happens when the community disbands. In the domain of dissertation writing, the boundary of a ‘community’ determines when the finishing stage would be. For example, if the community is only for a specific cohort of students, then the community disbands when that group of students finish their dissertations. We believe that much can be gained if knowledge can be passed on and shared across different years. The issue of sustainability, in terms of identifying common problems, sharing current practice in future studies, and engaging past members to become active participants in future communities, is critical. We intend to examine these aspects within the AWESOME use cases developed currently. The emergent semantics can enable us to analyse the AW practice and identify commonalities across disciplines and student groups (e.g. common concepts or similar process patterns), as well as discrepancies between practices and individual cases.

6 Discussion: Benefits from Semantics

AWESOME makes a novel technical contribution through bringing together standard Web 2.0 technologies (by incorporating many of the extensions available with MediaWiki) in an educational setting and shifts the focus from the result to the process of learning. In addition, and crucially to the project, AWESOME employs the MediaWiki Semantic Extension as the key driving mechanism in a fusion of the social and educational content in an accessible form. By annotating in a way that can be exported (using RDF) AWESOME opens the door to semantic search engines to enable the sharing of semantic content.

Semantic annotation provides the underlying structure to slice the content in many different ways through the use of ‘semantic queries’. Semantic queries provide a mechanism for continuous and incisive presentation of AWESOME content whether this is used to reflect the ambient mood of participants or the most popular academic writing ‘top tips’. ‘Educational data mining’ of the semantic content in this way may emerge as the key navigational tool, superseding the predefined process steps. There may be exciting fusions of annotation which clearly cross the social/educational boundary and also, as is the prerogative of free form collective intelligence spaces, the creation of new words e.g. `[[is daizy::<some great idea lazily pursued>]]`.

The concept of emergent ontology underpins the AWESOME dissertation environment as it is the de facto community model. A process model for AW has been used to build a seed ontology for the start up of an installation. Users are then empowered to add categories and properties (i.e. semantics) through participation in and use of the community environment. By monitoring the evolution of the emergent ontology, further behavioural data can be collected for a deeper understanding of how individuals and the community of practice progress within a particular discipline. By experimenting with more than one instantiation of the AWESOME environment, the emergent ontologies could be compared for the generic versus specific behaviour.

7 Conclusions and Future Work

The paper has presented a process-driven design and development of a semantically-enriched community environment for academic writing based on the pedagogical model of social scaffolding. We have reported initial results of the AWESOME project – an interdisciplinary partnership of academic writing communities, pedagogical experts, and software developers. Following active consultations with users and academic writing experts, we have been able to identify the main stages in the AW process. Consequently, a semantic wiki environment has been customised to provide effective support for the main stages in the AW process. The paper has also pointed out the need for support with the community processes, including forming, functioning and sustaining. We have examined this aspect very briefly using existing features in Semantic MediaWiki, and have pointed at possible future development.

Our research presents a case study that illustrates how Web 2.0 principles and tools and semantically-enhanced algorithms can be combined to address a long-standing educational problem commonly experienced across higher education institutions. The first stage has been to customise an existing semantic wiki platform to enable community-driven shaping and sharing of AW practice. We are currently preparing three instantiations of AWESOME at Leeds University - two different academic departments and the university skills centre. This will enable us to evaluate the effectiveness of AW support provided and to collect requirements for support with community moderation. Our future research will address the second aspect in designing effective semantic-wiki-based environments for learning as mentioned in the introduction, namely, adding intelligent features to enable better sharing of practice, as well as effective functioning and further sustaining of the community.

We believe that a new research trend in intelligent learning environments examining how to effectively exploit the marriage of Web 2.0. and Semantic Web will emerge. This can enable better learning content structuring, retrieval, and delivery, semantically richer modelling of community processes and individual needs, capturing context of use and creation of learning material, enhanced adaptability moving from addressing the needs of single users to addressing needs of communities. The work presented in this paper is an initial exploration in this direction.

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References

- [1] Aberer, K., Cudre-Mauroux, P., Ouksel, A.M, et al. (2004). Emergent Semantics: Principles and Issues, *Report of the IFIP Working Group on Data Semantics*, available from: <http://lsdis.cs.uga.edu/~kashyap/publications/dasfaa04.pdf>

- [2] Ankolekar, A., Krötzsch, M., Tran, T., Vrandečić, D. (2007). The Two Cultures: Mashing up Web 2.0 and the Semantic Web. In *Proceedings of WWW07*, pp. 825-834, ACM
- [3] Buffa, M., Gandon, F., Ereteo, G., Sander, P., Faron, C. (2008). SweetWiki: A Semantic Wiki. *Journal of Web Semantics*, 6 (2008) 84-97, Elsevier.
- [4] Clark, A (1997). *Being There*, MIT Press.
- [5] Dichev, C., Dicheva, D., Fischer, J. (2007). Identity: How to Name It, How to Find It. In *Proceedings of WWW07*, ACM.
- [6] Ghali, A.E., Tifous, A., Buffa, M., Giboin, A., Dieng-Kuntz, R. (2007). Using a Semantic Wiki in Communities of Practice. In *Proceedings of Workshop on Technology-Enhanced Learning Solutions for Communities of Practice*, TEL-CoPs2007, held at ECTEL2007.
- [7] Gruber, T. (2008). Collective Knowledge Systems: Where the Social Web meets the Semantic Web. *Journal of Web Semantics*, 6 (2008), Elsevier.
- [8] Ilgen, D.R., Hollenbeck, J.R., Johnson, M., Jundt, J. (2005). Teams in Organizations: From Input-Process-Output Models to IMOI Models. *Annual Review of Psychology*. 2005. 56:517-43.
- [9] Kleanthous, S., Dimitrova, V. (2008). Modelling Semantic Relationships and Centrality to Facilitate Community Knowledge Sharing. In *Proceedings of Adaptive Hypermedia and Adaptive Web-Based Systems, AH2008*, Springer, LNCS (to appear).
- [10] Krötzsch, M., Vrandečić, D., Völkel, M., Haller, H., Studer, R. (2007). Semantic Wikipedia. *Journal of Web Semantics*, 5 (2007) 251-261, Elsevier.
- [11] Kuhn, T. (2008). AceWiki: A Natural and Expressive Semantic Wiki. In *Proceedings of Workshop on Semantic Web User Interaction*, held at CH08.
- [12] Lange, C., McLaughlin, S., Rabe, F. (2008). Flyspeck in a Semantic Wiki: Collaborating in a Large Scale Formalization of the Kepler Conjecture. In *Proceedings of Workshop on Semantic Wiki SemWiki2008*, held at ESWC2008.
- [13] Lueg, C (2001). Information, Knowledge, and Networked Minds. *Journal of Knowledge Management*, Vol 5, Issue 2, 2001 (pp. 151 – 160).
- [14] Schaffert, S. (2006). Semantic Social Software: Semantically Enabled Social Software or Socially Enabled Semantic Web? In *Proceedings of SEMANTICS 2006*, pp 99-112.
- [15] Schaffert, S., Bischof, D., Bürger, T., Gruber, A., Hilzensauer, W., Schaffert, S. (2006). Learning with Semantic Wikis. In *Proceedings of Workshop on Semantic Wikis – From Wiki to Semantics SemWiki2006*, held at ESWC2006.
- [16] Siorpaes, K., Hepp, M. (2007). myOntology: The Marriage of Ontology Engineering and Collective Intelligence. In *Proceedings of Workshop on Bridging the Gap between Semantic Web and Web 2.0*, held at ESWC2007.
- [17] Wenger, E. (2001). *Communities of Practice: Learning, Meaning, and Identity*, Cambridge University Press.