Intelligent Information Technologies:
Concepts, Methodologies, Tools, and Applications

Vijayan Sugumaran
Oakland University, USA

Information Science REFERENCE

INFORMATION SCIENCE REFERENCE
Hershey · New York

Assistant Executive Editor:	Meg Stocking
Acquisitions Editor:	Kristin Klinger
Development Editor:	Kristin Roth
Senior Managing Editor:	Jennifer Neidig
Managing Editor:	Sara Reed
Typesetter:	Jeff Ash, Larissa Vinci, and Carole Coulson
Cover Design:	Lisa Tosheff
Printed at:	Yurchak Printing Inc.

Published in the United States of America by
Information Science Reference (an imprint of IGI Global)
701 E. Chocolate Avenue, Suite 200
Hershey PA 17033
Tel: 717-533-8845
Fax: 717-533-8661
E-mail: cust@igi-global.com
Web site: http://www.igi-global.com/reference

and in the United Kingdom by
Information Science Reference (an imprint of IGI Global)
3 Henrietta Street
Covent Garden
London WC2E 8LU
Tel: 44 20 7240 0856
Fax: 44 20 7379 0609
Web site: http://www.eurospanonline.com

Library of Congress Cataloging-in-Publication Data

British Cataloguing in Publication Data
A Cataloguing in Publication record for this book is available from the British Library.

Chapter 5.4
Discursive Context-Aware Knowledge and Learning Management Systems

Caoimhín O'Nualláin
DERI Galway, Ireland

Adam Westerski
DERI Galway, Ireland

Sebastian Kruk
DERI Galway, Ireland

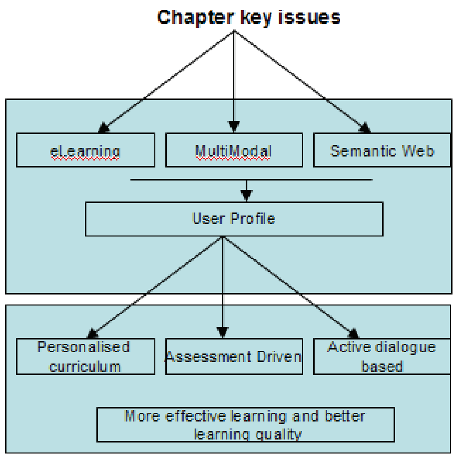
ABSTRACT

In this chapter, we look at the research area of discursion and context-aware information as it relates to the user. Much research has been done in the area of effective learning, active learning, and in developing frameworks through which learning can be said to be achieved and have some possibility of being measured (i.e., Networked Learning and Bloom's Taxonomy) (Bloom, 1956). Having examined many such frameworks, we have found that dialogue plays a large part, and in this chapter we specifically examine dialogue in context of the user's background and social context. This always plays a critical role, and it is around this that we want to dig deeper. We aim to provide a quality discourse analysis model which will achieve in more detail a picture of the users actual level of knowledge. Problem solving skills, together with the critical thinking capability as part of a team, and individually, in the following chapter.

BACKGROUND

Over the past 20 years, we have had many and varied computer-based and Web-based packages which aim to teach the user some skills. But most of these packages fail to achieve their design goals for one of many reasons, for example:

Figure 1. Hierarchy of topics



1. Lack of user driven focus
2. Lack of engagement
3. Poor navigation system
4. No eductational theory used or involved
5. Lack of challenge or testing of lessons learned
6. No assessment whatsoever
7. No feedback on any assessments covered
8. Lack of contact with anyone else doing the course
9. No followup in relation to a future path or career
10. No credits built up for future courses in work

These, through our research, tend to be the main reasons why computer-based training and Web-based training courses are not being completed. In this body of work we have taken these results and aimed to counteract them by developing a new direction, emphasis, and structure in how courses are created. Our initial aim is to greatly reduce the retention issues and to make courses more personally engaging and worthwhile. In so doing, new technology, which in the past had been used for the sake of being used and not to help in making courses more effective or useful, must be used effectively. These aspects are considered to be the failings of e-learning over the years (Badger, 2000; Crichton, 2003; Greenagel, 2002). In the next version of the Web, that is, Web 2.0, we will see far more powerful and useful Web-based applications based around the semantic information community. We will examine some applications which exibit some semantic options in the education area and in other areas later in this chapter.

Very important to this chapter and to learning utilities is the area of pedagogy, and the initial pedagogy frameworks examined was based on Goodyear (2001) and Salmon (2000), which deal with encouraging asynchronous methods of collaboration, but do not attempt to take into consideration the context of the user (i.e., gender, context, age group, or background). In fact, the collection of action verbs put together to aid evaluation of user input is very much based on language more likely to be used by middle aged academics rather than most of the student population (Figure 1).

Added to that was Socratic method (Hwee, 2000), in which the dialogue was based on the

Figure 2. Accepted active verbs from Bloom's Taxonomy

TCD Action Verbs for expressing Learning Outcomes (Bloom's Taxonomy)

			Critical Thinking		
Knowledge	**Comprehension**	**Application**	**Analysis**	**Synthesis**	**Evaluation**
arrange	classify	apply	analyse	arrange	adapt
define	describe	choose	appraise	assemble	appraise
duplicate	discuss	demonstrate	calculate	associate	assess
identify	explain	dramatise	categorise	collect	associate
label	express	employ	compare	compose	compare
list	indicate	illustrate	contrast	conceptualise	connect
memorise	locate	interpret	criticise	connect	consider possibilities
name	observe	operate	differentiate	construct	create
order	recognise	practice	discriminate	create	criticise
recall	report	schedule	distinguish	develop	design
record	restate	sketch	examine	distil	discriminate
recognise	review	solve	experiment	elaborate	estimate
relate	select	use	plan	formulate	evaluate
repeat	translate	write	question	initiate	generate ideas
reproduce			test	manage	hypothesise
state				organise	imagine
				prepare	judge
				plan	measure
				produce	visualise
				propose	
				synthesise	
				write	
Remembering previously learned information	*Grasping the meaning of information*	*Applying knowledge to actual situations*	*Breaking down objects or ideas into simpler parts and seeing how the parts relate and are organized*	*Rearranging component ideas into a new whole*	*Making judgments based on internal evidence or external criteria*

teacher-student dialogues with a high level of questioning involved to get the student engaged, develop their learning, and reinforce what they know, especially in terms of developing problem solving in an open discursive manner with the student's work group. Another body of research which we examined (Gee, 2003; Goldman, 2004; Money, 2005; Noriko Hara & Chaloula, 1998) paves the way to extending, to a much greater degree, what is possible and what we in this body of research aim to extend and adapt to an even greater extent and which we will illustrate later in the chapter and see in future years, the development of Web2. Ultimately, as a fundamental requirement for learning, constructivist principles, and more precisely, social constructivism, was applied in this model (Pask, 1997), very much building on the work of Piaget (activity is central to learning), Vygotsky (we learn from social contact), and Bruner (the concept of scaffolding). It is the research of these individuals that we use as the foundation to go forward and advance the argument or hypothesis for a more discursive, context-aware environment. It has already been clearly illustrated in Reigeluth (1996) where the quote "one size does not fit all" came from, which further justified and reinforced our aims at providing a unique user experience for each student based on their needs and requirements.

MAIN THRUST OF THE CHAPTER

With that in mind, we have captured much data about the user and body of users so as to learn more about the student and, in so doing, allow us to dynamically create screens which appeal to the learning style of the user and reinforce this with knowledge of the device type. It also allows the student to relate and feel very comfortable in the environment presented to the user. One of the aspects of this, which we can clearly illustrate, is the use of language, which can be either selected by the user or picked up from the student profile.

The effect of this will be that all material will be presented in the language the student is most familiar with, without having to buy additional versions. Similarly, with learning disabilities, such as dyxlexia, if the student indicates in the pre-test that they have this learning disability, the screens the student uses automatically alter so as to be presented in a mint green, and limited text

Figure 3. Literature review

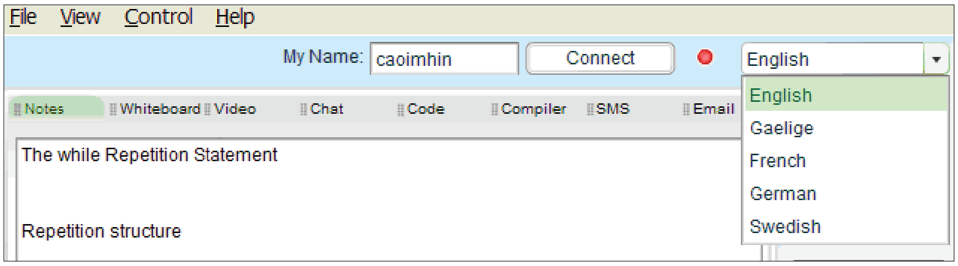
Issue	References	Main contribution
E-learning & Learning	Reigeluth, C..M., 1996	What is the new paradigm of instructional theory?
	Britain & Liber, 1999	Framework for evaluation of VLE s
	Salmon, G.,2000	E-moderating: The key to teaching and learning online
	Goodyear, P. , 2001	Effective networked learning in higher education: Notes and guidelines
	Pask, G., 1997	An idiosyncratic history of conversation theory in software, and its progenitor
	Oviatt, S., 2004	When do we interact multimodally? Cognitive load and multi modal communication patterns
Semantics for E-learning	Quesada, J., & Kinsch, W., 2000	A computational theory of complex problem solving using latent semantic analysis
	Dodds, L., 2004	An introduction to FOAF
	Kruk, S.R., 2004	FOAF-Realm - control your friends' access to resource. In Proceedings of the 1st Workshop on Friend of a Friend, Social Networking and the (Semantic) Web (FOAF Galway), Galway, Ireland, pages 1–9.
Profiling and Personalisation	Talaveral, L., & Gaudioso, E., 2004	Mining student data to characterise similar behaviour or groups in unstructured collaborative space
	Nuallain, C.O., & Redfern, S., 2005	Providing more effective curriculum through building dynamic profiles and tracking user behaviour
	Britain, S., & Liber , O., 2004	A framework for the pedagogical evaluation of virtual learning environments

will be displayed on the screens and icons appear on buttons rather than text, which research has indicated is an aid to usability and readability for dyslexic students .

As part of this flexability and collaborative interface, we have adapted and utilised technology for the sake of learning, to provide the user with more ways of interacting with the curriculum, both asynchronously and synchronously. Through the methods provided, we can increase the level of engagement, as indicated in Figure 5, which provided student survey results of environment, but also allow the tutors, teachers, and moderators the opportunity to capture and give valuable feedback, which was not possible in other environments. All of this is captured and stored in the users profile.

The survey relates to aspects of test versions of the current application, which show aspects of satisfaction the users indicated from using the application as part of a computer programming course. The programming course and some of the difficult concepts really challenged and tested us severely.

Figure 4. Language options for the user



The Profile

The profile in place is made up of 25 categories which cover all user significant features, including personal data about age, background, whether they are town dwellers or city dwellers, type of work, and hours of work. Added to this is assessment and tracking information on how the user navigates the course. Altogether, 150 fields are used to collect user data, which for the most part help build up a picture and allow the course to change so as to suit the learners needs and specific requirements. This can be a stand-alone package or a corporate package, which can inform the boss as to the user's ability and aptitudes. The assessment module which forms part of this package is designed specifically for the user taking part in the course, as it reacts to replies to questions in the pre test and to the way the user uses the course which maps to their learning style and changing learning style. This user profile ultimately has as its core options to produce reports which inform us as to many different aspects of the user's ability and attentiveness, even which aspects of the course users do not like while completing or taking part in the course. The assessment aspects are very thorough and again adapt to the user's style and options selected and the input or contribution they make to the course. The assessment model is outlined in the diagram below.

This assessment framework is very thorough and is both formative and summative. But as a result of the problem solving nature of the package, it is also very interrogative and tries to probe into how a user went about solving a problem and why, and then establishes if problem solving skills are being learned or if "test and click" is being used so as to get through the course as quickly as possible. This aspect is best achieved through the tracking and dialogue aspects of the assessment framework. To further reinforce the learning, there are several dialogue aspects where users are encouraged to discuss problems and material with their work group or tutor so as to build and correct scaffolding that may be forming. It is the brainstorming and dialogue which has proved itself as being most effective in tests carried out over the 3-year duration of experiments. We have also found, as a result of the collaboration aspects, that we have established a 98% retention level, with students asking for more events like this one in other subject domains. Overall, this environment, which engages students in programming and problem solving after several permutations, has found the right mix and is now very successful, and both engaging and motivating through building on success and meeting and talking with classmates or study groups to work through problems online.

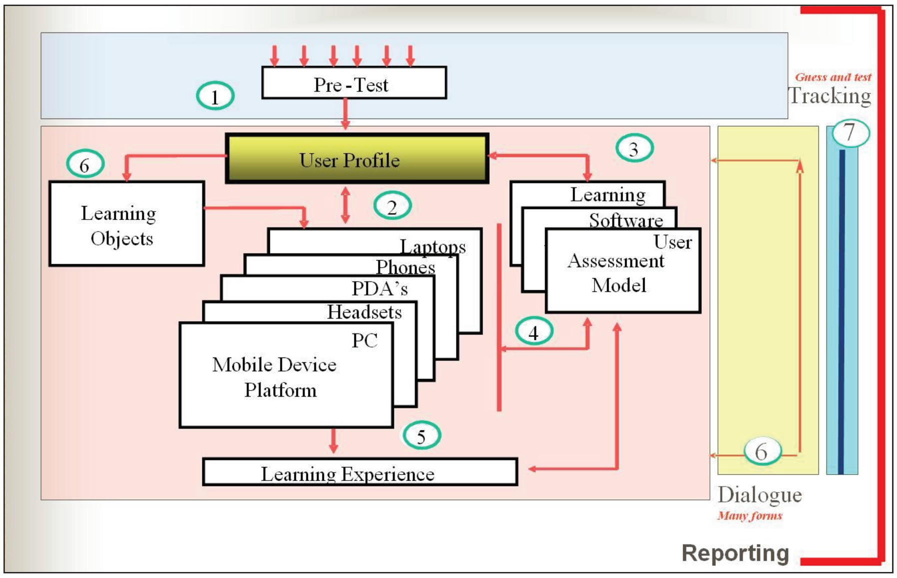
The online aspects, just like the users, are varied and diverse. There are several ways of

Figure 5. Survey results of aspects the students liked

%	Student reply's to usage
53	competed for the practice
53	competed for the fun
53	said this helped their programming a lot
60	Said they would like to see this type of collaborative environment online
93	would like to get involved in another one like this one next year
60	Internet surfing
60	e-mail
13	24 X 7 access
67	Solutions online
73	Your team score online
53	Online chat
60	Live audio with class and tutor
47	Marking scheme online
60	Hints and tips online
55	Texting
50	Live video with classmates
40	Notes online
40	Compiler
53	Has the competition helped you like college life more Y/N
53	Has it helped you to be able to look for help if you needed it?
20	Outline of mistakes in better feedback

collaborating both synchronously and asynchronously within the model currently being user tested. The methods and features were those specifically requested by users. The example of SMS messaging came about from data indicating that 100% of students had mobile phones, which was much higher than the numbers with personal computers and personal computers with Internet connectivity. With the subsequent selection on dialogue methods and richness, we facilitate dialogue or discursion and, as far as is possible, reflect the context of the user and their learning preference. With most of these collaboration features we allow archiving of student conversation and tutor conversation so as to provide a very good reflective tool which can be reviewed in the user's own time and place. The dialogue, as can be seen from our model, is assessed, monitored, and graded, with the aim of giving beneficial feedback and correcting misconceptions that may have been picked up. Many of these modalities present their own specific challenge in this regard, as it is not immediately obvious how to assess them and how to grade them. But our model does just that with the use of rubrics and moderators applied to each modality to maintain quality. Quality through dialogue can often be an issue, especially with people from different locations with different

Figure 6. Model of the assessment carried out as part of our framework



accents and lilts, which can make the level of understanding difficult, and as a result difficult to assign marks and grades. This aspect we have also taken into consideration and catered for in our assessment model and through the moderation aspect. The moderators in the Salmon and Socratic method also try to drive conversations (Salmon, 2000, 2002), which primarily build up skills in asynchronous dialogue but which can also be applied to the assessment model with sufficient adjustment and consideration of the technology used. As part of the assessment module used, it has become apparent that one of the most useful features for the users and the tutors is the feedback aspect, which can be used very much for multiple purposes. Firstly, the users can get answers to queries which were hindering their progress. Furthermore, through presenting more problems to the user, the level of understanding and feedback uptake can be measured. This in itself can be used to illustrate how effective a learner is at applying knowledge, learning, and ultimately aiming to achieve high order learning. If these goals are not being achieved and the user is somewhat frustrated, another modality may be suggested by the moderator following usage patterns displayed as a result of pre test data or tracking data, which may indicate the user has selected the wrong learning style or modality in which to learn and, although their learning ability will not be stopped, it may not be their preferred environment to use.

Interoperability, or cross platform usage, is a major hindrance to uptake and investment in a package or e-learning package, and questions may exist like *"Is it going to be compatible with the new and old system?"* and *"Can the data in the old system be integrated into this one?"* Quite often packages are created with no consideration to compatibility with other products or old systems and future proofing. With passing years has come about standardisation, taken place in different forms. Firstly, with better ability to interoperability comes better compatibility. From the point of view of the changing Internet world, this has brought about great change, and the creation of object libraries that can be used and reused and altered without requiring whole course rebuilding.

It also means great cost savings as object libraries can be bought and exchanged as needed. This has in turn changed the e-learning market to one of course creation, object creating, and adaptability. This again has cost savings for the developer and will allow the user greater flexibility in terms of the style of object they use, based on their personal preference, and give a different perspective and greater understanding of the context. It is this standardisation that is driving the next version of the Web and allowing material to be adapted for other device types very quickly and cheaply in comparison to past development life cycles. These approaches in terms of future proofing are far more sustainable and have driven the development of the Semantic Web, as outlined in the following pages.

In this section, we will be discussing our research in the broad area of "Discursion" and "Context-aware" information. There is a growing body of research into learning collaboration, and we have related this research to our body of work that investigates the effectiveness of our collaborative model (Nuallain, 2004, 2005) and the importance of all aspects of discursion, fundamentally asserting that knowledge of context is essential to provide a quality discourse analysis.

Semantic Web 2.0

When Tim Berners-Lee invented the World Wide Web, it was a mere collection of HTML documents. Soon, and rapidly, it grew to the stage we have at the moment. Internet has become more than just a source of information. It has become a source of entertainment, communication, and last but not least, business opportunities. However, with the search engines as robust as Google, everyone has the feeling that we cannot grow the Internet the way we did so far. Even now, many people just cannot efficiently search for information. Our B2B systems suffer from hard-to-overcome heterogeneity.

Second-generation Internet is currently the hot topic, both in industry and academia. It is perceived as a remedy for all problems we know from the current Internet. However, academia and industry define the future Web in different ways.

FUTURE TRENDS

Research centres around the world work on the Semantic Web. In their vision, the future Internet will be more than just human-understandable text. The idea is to add machine-processable meaning to current and future information. Future search engines on the Semantic Web will be able to understand both the information they index and users' queries they process. B2B systems will be able to cross the boundaries of heterogeneity and find better deals with partners they cannot communicate with at the moment. However, there are a couple of concerns with respect to the Semantic Web, such as who should provide the machine-processable descriptions, that are still to be answered.

Web 2.0 is the Holly Grail of the contemporary Internet companies. Instead of making the information machine-understandable, Web 2.0 brings whole communities of users to interact with the information and each other. Wikis allow groups of people to edit the information in truly collaborative fashion. Endeavours like *http://www.wikipedia.org/* (wiki-based Internet encyclopaedia edited by an open community) proved the immense potential of community impact. Web 2.0 is also about the tagging. In services like deli.cio.us or Flickr, community users annotate bookmarks or photos they share with a simple set of keywords. As opposed to the old Web, everyone can annotate each resource. And in contrast to the Semantic Web, there is no meaning applied to each keyword (no disambiguation); however it is much easier to edit the information.

Semantic Web also aims to grasp the potential of online communities by initiatives like FOAF (Dodds, 2004) (friend of a friend), that describes online communities in a semantic fashion. FOAF-Realm (*http://www.foafrealm.org/*) is one of the projects based on FOAF metadata, with its flag product, distributed profile management system (D-FOAF). One of the interesting features of the D-FOAF is the social semantic collaborative filtering (SSCF) [1] that incorporates solutions known from collaborative filtering, the Semantic Web, and Web 2.0. Other projects, like semantic wikis, also aim to utilize social semantic information sources defined by emerging Semantic Web 2.0.

The Potential of Semantic Web in E-Learning

In the early 1990s, e-learning was pushed as the "killer application" of our time, as it was to allow the delivery of education to everyone, everywhere. It was also promised to allow a high level of flexibility, as the users could log on at any time and continue their learning when it suited them best. This led to a high degree of popularity for the concept of e-learning and the potential that could be achieved through it in terms of learning. The development of e-learning had associated with it the big advantage of cost efficiency over instructor-led training. However, much of the promise was just as much a gloss as the material available. The material lacked instructional design, educational potential, engagement, and any feedback to the user. Despite the use of the Internet, the courses are very static and flat. Further enhancing of acceptability of courses is limited by the lack of bandwidth and limited access of people to computers and the Internet.

Due to the big growth of the popularity of e-learning, it quickly became much more then just delivering courses in order to provide electronic equivalence of academic-like courses. Companies that consider themselves to provide e-learning services have very diversified areas of interest. The scope of delivering or using e-learning services can be understood as broadly as the very meaning of concepts like learning and knowledge transfer. The level of competition between contemporary solutions is pushing e-learning into new areas that could bring additional profits and attract new users. One of the domains that can offer a lot is Semantic Web.

Applying the idea of Semantic Web in the e-learning domain can lead to better understanding of user requirements or needs, and therefore delivering content that suits him best. This can be achieved by providing extensive metadata descriptions for various e-learning content and mechanisms to reason about those annotations. One of the aims of Semantic Web is to provide machine understandable content. As far as e-learning is concerned, this can be understood in many ways. One is creating systems that support users with some feedback based on automatic recognition of their needs and correlating it with the best possible learning paths. On the other hand, user interaction and activity carry a lot of useful information, which can be used in a variety of ways to improve the quality of learning experiences. To utilize this potential as much as possible, the information from all learners should be gathered, shared, and reused. Moreover, the learners should be able to adjust and refine the process of instruction and make their own annotations and bookmarks.

Choices made by a particular learner can indicate what the prerequisites for a given learning object are. We know the user profile: capabilities, preferences, history, courses taken, and so forth, and we can assume with some probability that these properties are needed to start this course. Collecting similar information from other learners, we provide more and more accurate assumptions. After reaching a particular line of certainty, a metadata of the considered learning object can be updated, and new information reused in the future to better suit the learner abilities.

The same can be applied to acquire information about learning unit objectives. Observing the choices of the learners after they have finished a given learning object gives us clues and hints about new skills gained by the user.

Moreover, the choices made by a learner during a course can be stored and reused to propose a similar path for another similar person interested in the same topic. This way, experiences of other people can help to teach new pupils in better, more adjusted fashion.

Bookmarks and annotations of individuals also carry important information [17]. People create their own classifications and hierarchies, which are of use for others who try to find interesting materials from particular domains of interest. We believe that learners should form a more collaborative, open community and share their knowledge. This improves acquiring new information.

To facilitate searching, discovering, and learning, bookmarks and annotations of other people are freely available. Intersecting Semantic Web with social aspects introduces this feature with the possibility of making some restrictions. Various personal ontologyies can be used, like Distributed Friend of a Friend network [18, 19], to store and manage user profiles. It enables exchange of the bookmarks and other information between different people. Moreover, groups of friends who share more data (e.g., their entire user profiles) can be created. This additional advantage that semantics provides is supplying new users with the possibility to add their friends to the list of known people. Using this information in the profile, we can conclude some initial knowledge about these new learners.

Semantic Web also provides a means to deal with a wide diversity of metadata formats for describing learning objects and user profiles. To address this problem an ontology approach for modelling problem domains is proposed.

Architecture of Semantic E-Learning Systems

As noted before, the key element of Semantic Web is annotation resources. In order to address previously described benefits, the following should be concerned:

- Ontology for e-learning content
- Ontology for user profile
- Composition of learning objects

These are the basis of the architecture of an e-learning system based on the social semantic information sources (see Figure 7).

Ontology for Legacy Content Description

Contemporary learning systems describe their resources using mainly Learning Object Metadata, Dublin Core, BibTeX, and many of their own formats, which are created to fulfil the needs of particular product or company. Although those specifications are mature and exist for a long time, they miss some key concepts needed to utilize our ideas.

We distinguish two goals for resource description.

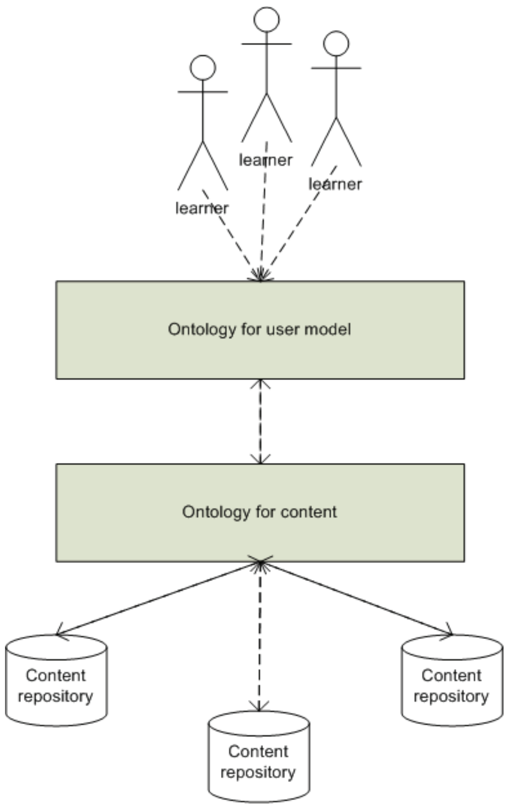
- Express common concepts in different formats
- Preserve the information acquired from user actions (e.g., prerequisites, objectives)

To address the first problem, we propose using an ontology approach. Common conceptual level will preserve the semantics of different descriptions and ease the mediation between them. This will ensure cooperation of heterogeneous environments, which use different formats to accomplish their tasks [20,21].

Ontology for User Learning Profile

In order to deliver a personalised content, the system gathers as much information about the user as possible. FOAFRealm ontology used to store this information, will cover a wide area of different aspects of a learner's profile:

Figure 7. Architecture of the future e-learning system



- **Resume:** Personal description of a user, including education, areas of expertise, work experience, career level, and so forth
- **Capabilities:** Circumstances that may affect the learning process (e.g., user's disabilities) and also a description of equipment used (e.g., a mobile phone with a limited display).
- **Actions:** History of user's choices about courses and learning objects (e.g., which of given alternative course parts were picked). This part of the ontology will cover all different paths and scenarios chosen by the user. Such information will be used to help the user with his future choices and also as advice to other people who have similar preferences.
- **SSCF (social semantic collaborative filtering):** Bookmarks with courses and objects that users find valuable or interesting. This information will be reused as suggestions for their friends and people with similar interests.
- **Friends:** Data about friendships from FOAF profiles. If there is not enough detailed information about the users (for example the users have not fully filled their profiles), preferences of their friends might be used for personalisation (assuming that generally friends have common interests).

Information from each of these parts of the ontology will influence the learning process and materials composition in different ways. Resume will provide a hint on user's interests and will help to decide which materials are inappropriate for a particular user (a seasoned engineer should not be taught basic math, etc.). The Capabilities section obviously determines presentation techniques which might be used and the device to be used to convey the information.

Information deduced from user actions has to be stored in the resource description.Contemporary metadata formats do not provide sufficient vocabulary for such purposes and thus have to be extended. We need to express information about prerequisites and learning objectives more precisely. Learner choices will help to determine exact abilities that are needed to start a certain learning object and which are gained after finishing it. New vocabulary to describe these two aspects will be added to the user model ontology.

Learning Objects Composition

This section describes the usage of ontologies discussed previously in order to create user-oriented courses. E-learning object ontology and user profile description are key elements for a mechanism that composes courses according to individual user abilities and preferences.

The subject of various objects orchestration can be examined from many points of view. The one that is reasoned and researched often is composing based on workflow of specific information. Such techniques can be very clearly seen in research concerning Web services composition. During searching for components that will fulfil the users' task, the most important goal for the system is to match compatible services within the flow in a way that will enable the transfer of data from one service to another in the chain. The solution of this problem allows the reusing of previously processed data and composing a bigger functionality from smaller parts. Although similar attempts have been made in the e-learning domain by introducing tailoring of an object's size and level basing on some input parameters [22], this chapter takes into account user requirements concerning e-learning products, and extends the discussed meaning of composition. In order to bring users greater satisfaction from the system on-the-fly, proposed courses' composition techniques consider proper object ordering within the flow. They are not only based on technical aspects of connectivity of one object with another, they but also deliver various descriptions of object content and their relation to user description.

The main idea which could lead to achieving our goal is by taking advantage of benefits brought by initiatives like FOAF user profiling [17, 18, 19]. Collaborative filtering technologies allow the finding of people with similar interests and extracting data about their choices while composing courses for their needs. In the final solution, the users will interactively select the track that they want to follow, choosing components suggested by the system. Recommendations will aim to user requirements. In general, to prepare a course, some pre and post conditions for each object are needed.

According to our current research, there are two main sources of preconditions. The first source is based on user profiling, as mentioned previously. While creating a course, the system should dynamically create a list of possible objects that the users could select from; the contents of the list should be based on choices of people of similar interests. The definition of the similar interests concept can be understood in various ways depending on the amount of knowledge the system has about current users. In the best case, the system would be up to analysing choices of people that the users themselves declared of similar interest (e.g., by utilizing functionality of previously mentioned FOAF technology). If we are dealing with totally new users who has not described by themselves people of similar interests or assigned themselves to some kind of user group, system reason can be used based on information like nationality, occupation, and so forth.

The second source of preconditions is a less innovative idea, but also very important, especially when prior information about the user is not available. The ultimate goal of composing the course can be aided by analyzing definitions found in objects description ontology that contains some suggested predefined user's experience and level and specifies the context of the object in a given domain. The predefined descriptions of a required user level are a good guide for the system at its bootstrapping. Taking notice of object context is far more important even when the system has wide knowledge about users and their learning choices. By analyzing the paths users have taken during the course, the compassion system can find objects that are popular at some point of learning in a given subject but do not necessarily concern the subject directly. For example, while learning Spanish, at some point many foreign users might have chosen to learn about Spanish history. That fact should result with the system proposing Spanish history lessons to a new foreign user that is only interested in learning the language and grammar. By comparing object context with user expectations, automatic course generation can be controlled in a way to give better results and to satisfy users more.

In order to maintain the quality of proposed courses, while the user selects one of the given options, the system should be able to track post conditions of the user-selected object and modify further parts of the course. Post conditions are information defining what benefits the user gains by completing an e-learning object and what level he will hold after. At this point of the research, to achieve the goals described at the beginning, we assume to extract this information only from fixed descriptions stored in object ontology. Ideally, this information could also be created dynamically on-demand by analyzing what similar users have learned after completing the course. This solution, however, assumes some additional input from the user to rate objects and is rather meant for future research.

Sample Application Description

Storage and sharing of educational information is a crucial element of e-learning. A social semantic digital library called JeromeDL is an example of a system that can be applied in e-learning as a user orientated knowledge repository. It is one of the first systems that bind together the preciously described Semantic Web and Web 2.0 efforts.

The idea of social semantic information sources has been implemented in a 2-layer metadata enrichment architecture. The lower layer is responsible for lifting up enriching concepts of legacy metadata like MARC21, BibTeX, or DublinCore to the semantic level. This allows the interoperability with already existing legacy digital library systems. However, the legacy metadata (especially MARC21) is usually hard to understand by an average user of a digital library. Therefore, JeromeDL delivers a second layer of metadata enrichment that is community oriented. Communities of users (and authors) can interact in the Web 2.0 fashion by tagging resources through the Social Semantic Collaborative Filtering (SSCF) interface. SSCF allows users to annotate resources (and share those annotations with their friends) according to the way they perceive the world. Semantic information managed by both layers of metadata enrichment is later used by the semantic query expansion algorithm that takes user interests into account. Ongoing research is looking into using social semantic DL as a source of future LOs.

CONCLUSION

As has been indicated, much of the wrongs that have taken place in e-learning can now be rectified with the framework outlined in the research in this chapter and through the use of the current research being carried out in the Semantic Web, which in conjunction with the collaborative aspects, can overcome and drive a new, exciting, and engaging learning future on the Web. We have indicated some ideal current developments in the e-learning area, the semantic potential and its possible impact on learning through profiling, and the complicated assessment model. The semantic technology can deliver all aspects of the model outlined in our research.

REFERENCES

Badger, A. (2000). *Keeping it fun and relevant: Using active learning*.

Bloom, B.S.E. (1956). *Taxonomy of educational objectives: The classification of educational goals: Handbook of , cognitive domain*.

Crichton, S. (2003). Innovative practices for innovators: Walking the talk. *Online training for online teachers*.

Dodds, L. (2004, February). *An introduction to foaf*.

Gee, J.P. (2003). *An introduction to discourse analysis: Theory and method*. London: Routledge.

Goldman, R. (2004). *Speech interaction for mobile devices: A natural solution to a contextual conumdrum*.

Goodyear, P. (2001). *Effective networked learning in higher education: Notes and guidelines.*

Greenagel, F.L. (2002). *The illusion of e-learning: Why we are missing out on the promise of technology.*

Hwee, Y. (2000). *Assessing critical thinking through scaffolded asynchronous online discussion.*

Money, A.G. (2005). Once more with feeling: An emotional approach to multimedia context analysis. *IASTED05.*

Noriko Hara, C.J.B., & Charoula, A. (1998). *Content analysis of online discussion in an applied education psychology. 2*(28), 115-152.

O'Nuallain, C., & A.B. (2004). How can one effectively assess students working in a collaborative mobile environment on an individual basis? *MLearn04.*

O'Nuallain, C., & Redfern, S. (2005). The promotion of effective learning through collaborative methods in a wireless ubiquitous environment. *CAL05.*

Pask, G. (1997). *An idiosyncratic history of conversation theory in software, and its progenitor, gordon pask*.

Reigeluth, C.M. (1996). What is the new paradigm of instructional theory.

Salmon, G. (2000). *E-moderating: The key to teaching and learning online.* Sterling, USA: Kogan Page.

Salmon, G. (2002). *E-tivities: The key to active online learning*: RoutledgeFalmer.

This work was previously published in Ubiquitous and Pervasive Knowledge and Learning Management: Semantics, Social Networking and New Media to Their Full Potential, edited by M. Lytras and A. Naeve, pp. 293-310, copyright 2007 by IGI Publishing, formerly known as Idea Group Publishing (an imprint of IGI Global).