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Workshop on Learning Technology for Education in Cloud (LTEC'12)

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Preface

The use of technology for learning has grown tremendously in the last decade. The need for continuous just-in-time training has made learning technology an indispensable part of life for workers. Learning technology of the future means that we can access programs anytime and anywhere. We can use our laptop or iPad or even cell phone to access educational technologies. Tomorrow's educational technologies are based on cloud computing. It's a natural extension of today's educational technologies where we access these software programs online. Cloud computing offers great potential in education by also allows students to interact and collaborate with an ever-expanding circle of their peers, regardless of geographical location.

This first workshop on Learning Technology for Education in Cloud (LTEC'12) provides opportunities for delegates to discuss the latest research in TEL (Technology Enhanced Learning) and its impacts for learners and institutions using cloud computing. Learning technology is a type of system that provides educational services to students. Nowadays, we are living in a world of increased mobility where proliferation of mobile technologies is creating a host of new anytime and anywhere contexts. The emerging social media of Web 2.0 are more flexible, sociable and more visually attractive. We live and learn in a connected world. Schools, colleges and universities must change to adapt to these new needs and expectations. This highlights the need for innovative solutions in education and learning.

In this workshop we explore a number of issues surrounding the use of technologies in learning, providing a platform for informed debate across all sectors of education and learning. The workshop allows researchers, practitioners and academics to present their research findings, works in progress, case studies and conceptual advances in areas of work where education and technology intersect. It brings together researchers across all educational sectors, from primary years, to informal learning, to higher education across a range of disciplines from humanities to computer science, media and cultural studies with different perspectives, experiences and knowledge, all in one location. It aims to help practitioners find ways of putting research into practice and for researchers to gain an understanding of real-world problems.

The LTEC2012 proceedings consists of 19 papers covering different aspects of learning technology from many different countries including, Brazil, China, Croatia, Tunisia, Taiwan, France, Slovenia, Netherlands, Spain and United Kingdom. We would to thank our program committee, reviewers and authors for their contributions. Without their efforts, there would be no workshop and proceedings.

Salamanca
July 2012

Lorna Uden
Emilio S. Corchado Rodríguez
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Contents

An Approach for Supporting P2P Collaborative Communication Based on Learning Profile

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Abstract. The growing use of small devices as cell phones and smartphones has requested for the development of applications in different areas. This kind of application demands for a local communication, called collaborative communication, between the devices without the Internet infrastructure, allowing the sharing and exchange of contents. In the e-learning area this is not different and these applications potentially attract the students' attention. In the meanwhile, in the e-learning area, the offering of relevant and interesting content can attract the student's attention, motivating him during the learning-teaching process. The goal of this work is to propose an approach for supporting P2P collaborative communication based on the comparison of learning profiles and learning object metadata. The learning profiles are split into dimensions based on Felder and Silverman model to attend different student preferences. A prototype was developed and tested to validate and evaluate our proposal.

1 Introduction

The miniaturization of computational devices for personal use along with recent advances in communication technologies has significantly expanded the access possibilities to a wide range of applications in several fields. Nowadays, it is possible to read e-mails, make financial transactions, share resources (hardware, software and data), access multimedia content, and enjoy a variety of other applications through a small devices.

Although the mobile devices have resources to communicate through the Internet, there are scenarios where communication is more localized, without the need of the Internet infrastructure. The daily interactions between people at work, university and where they live are much more evident when compared to global interactions. The common scenarios include collaborative peer-to-peer (P2P) interaction to share files and downloads together, interact to exchange data such as music and videos, and opportunistic communication. In these scenarios there is no need to use the infrastructure of the Internet in terms of domain name service (DNS), routing and addressing. All these aspects could and should be resolved locally through local services, allowing the collaborative communication.

The student's learning style is one of the ways to highlight the features that characterize him, such as: personal and social preferences, learning profile, and

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subject knowledge level. The exchange and sharing of materials between two students can further enrich the learning process when they use contents which are adherent to their learning profiles. The observation of learning styles provides users with different teaching strategies, meeting the student's individual needs. In this sense, it is important to highlight that the student learning style should be observed through different dimensions achieving diverse aspects of her/his preferences, such as media format and participation in group activities [4].

The dynamic linkage between contents and student's learning profile may enhance the adequacy of the learning objects that will be exchanged and shared between the students. The use of metadata standards adds quality to learning systems in the task of handling learning objects, improving their reuse and retrieval [1,2]. Learning objects are specified by fields that describe their general data (e.g., title, description, keywords), technical details (e.g., media format, size, software and hardware requirements), learning features (e.g., concrete and abstract approaches, visual and verbal elements), and other relevant metadata [3].

This work presents an approach for supporting P2P collaborative communication based on learning profile. It is proposed a model that allows small devices to share and to exchange learning objects through a P2P communication. Besides the supporting of communication technologies, it is considered the learning profile and topics of interest of the students involved in the process. Upon successful connection, the student who requested the communication will view learning objects of another device that he has interest and then he can request the transference of the learning objects. Metadata are adopted to describe the learning objects and the learner profile. An application was developed in Android platform[1] using Bluetooth technology to evaluate the proposal. Another application has developed to permit the learning objects, their respective metadata and the student's learner profile retrieval from an Amazon cloud to the device, providing a diversity of materials to the evaluation of the model. The design of learning and teaching's process is not consider into the scope of this work.

The remainder of this work is structured as follows: Section 2 explores related concepts: learning profile, learning object and collaborative communication; Section 3 presents the approach proposed here and its validation; Section 4 reports some related works; and Section 5 discusses some conclusions and outlines future works.

2 Theoretical Background

The learning profile has an important role to support the e-learning systems. Understanding the learning preferences of the student can assist in providing more meaningful objects to him. Each individual fits into a specific learning style, what makes him to adopt attitudes and behaviors that are repeated in different moments and situations [5]. Learning styles refer to highly individualized tastes and trends of a person, that influence their choices during the learning process. The student motivation can be improved when an e-learning environment supplies the student with elements that are in accordance with the individual's learning style.

There are several models used in the characterization of learning profiles, each of which is suitable for a different learning scope: the Myers-Briggs Type

[1] http://code.google.com/android/.

Indicator – MBTI, Kolb's Experiential Learning Model, the Hermann Brain Dominance Instrument (HBDI), the Honey-Mumford's Learning Styles Questionnaire (LSQ), and the Felder-Silverman Model [4]. Among the possibilities of leaning style modeling, the Felder-Silverman model [5,6] was chosen to be used in this work due to the model has the strongest emphasis on the relationship of learning styles and teaching strategies. Besides, the model is largely employed in computer and engineering courses that are important areas for us. This model uses the concept of dimensions, and therefore describes learning styles in different perspectives. The dimensions also facilitate the association of learning objects with learning profiles. Table 1 presents the model's dimensions adopted for us in this work.

Table 1 Adapted dimensions of the Felder and Silverman model.

Dimensions	Features	Learning Styles	Teaching Methods
Perception	The focus is in the best way through which the student can obtain information: contents, exercise types, for instance.	Sensing	Concrete
		Intuitive	Abstract
Presentation Format	It is related to the input. Content preferences chosen by the student such as media types.	Visual	Visual
		Verbal	Verbal
Student Participation	It represents the student preferences for the activities participation or observation.	Active	Active
		Reflective	Passive

Learning environments have different goals and of them is to offer educational material, usually called learning objects (LOs). In this context, LOs must be selected so as to correspond to the students' preferences. One of the ways to organize learning objects so that they can be used and reused systematically is through the use of descriptive metadata, that is, a set of attributes that describes learning objects. The LOM (Learning Object Metadata) standard [7] of the Institute of Electrical and Electronics Engineers (IEEE) is the most commonly metadata specification used for e-learning. The LOM standard has a structure that describes learning objects through descriptor categories. Each category has a specific purpose, such as describing general attributes of objects, and educational objectives. Table 2 shows the LOM categories adopted in this work.

Table 2 Description of LOM categories.

LOM Category	LOM Field	Characterization
General	Identifier, Type, Title, Language, Description and Keywords.	General description of the learning object.
Technical	Media Format (video type, sound), Size, Physical location, Requirements (object use: software version, for example).	Technical features description.
Educational	Interactive type (active, expositive).	Educational functions and pedagogical characteristics object description.
	Learning Resource Type (exercise, simulation, and questionnaire).	

In the communication side, the collaborative communication between two network devices can be classified into two types. The first one considers a collaborative communication when the most of the features to support collaboration occurs at local level. Functions such as routing, name service, finding context and message forwarding are performed without the use of a global network infrastructure. The second one uses a global infrastructure (Internet, for example) adopting the services provided by such infrastructure. There is also the possibility of a hybrid model that takes into account the two types of communication [8]. The collaborative communication is provided by different technologies with a variety of features such as autonomy, interoperability, available to share data, context sensitive, and the appropriate use of hardware resources.

Among the features mentioned above *context sensitivity* has become a key element in collaborative applications. A Context-Sensitive Application is able to adapt its operations without explicit intervention of the users, providing information and services that are relevant for users to perform their tasks using information taken out of the interaction context [9]. In this sense, context plays a key role to enable applications to refine the available information into relevant information, to choose appropriate actions from a list of possibilities, or to determine the optimal method of information delivery.

3 The Proposal Approach

The student's satisfaction with the materials offered by an e-learning system is fundamental in order to achieve the user approval. For the intent of offering quality, the relationship between the student and the system is built upon the tracing of personal preferences, reproducing the users' expectations. Hence, learner profile is one of the most important components of e-learning systems, storing the relevant data about user preferences [11].

Based on concepts of learner styles, learning objects and collaborative communication, this work describes a model to supply the sharing and the exchanging of learning objects through a P2P communication, concerning in the student's learning profile. It was shared learning objects to the student involved in the communication, organised according to the LOM standard, based on the observation of the following criteria: keywords describing the students' interests and students' learning profiles. The next subsections will report the elements of our proposal.

3.1 Requirements

For the proposed approach be adopted, some requirements must be attended. The first one is the learning objects available on the collaborative communication must be cataloged using LOM standard. The proposal adopts only the LOM categories and fields described in Table 2.

Another requirement is that the learner model needs to report the student learning profile using dimensions based on Felder and Silverman (Table1). A learner model contains relevant information to attend a system needs to automate tasks. The learner model adopted in this work contains the student identification, keywords that represents his learning interests and learning profile split into three dimensions: perception, presentation format and student participation. A local repository of learning objects, their respective metadata and the student's profile must be stored into the devices. This repository can be updated when the student's searches changes.

3.2 The Collaborative Communication

In this paper it was considered the collaborative communication with local support of network functions without the use of Internet infrastructure. The devices involved in a P2P communication can perform both roles in different situations: client and server. The roles are dependent on who starts the communication requesting that is the client. The interaction starts after two devices have been found and recognized. When a device's Bluetooth system is active it scans for other active devices. The student selects the device he wishes to connect and then the requesting device becomes the client and the other the server. As the result, the communication is established and the collaborative process begins automatically. The scan and the connection process can be developed according to the technology adopted in the communication. The different technologies supply the developers with API to provide these implementations.

The proposed model contains two main components ***Context Manager*** and ***Object Sharing Manager***, which both are composed of other subcomponents as shown in Figure 1.

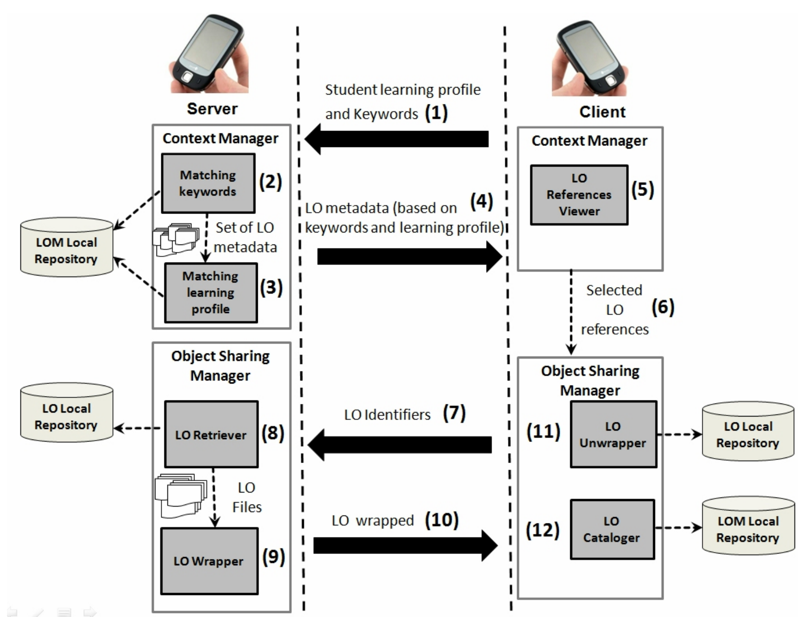

Fig. 1 P2P collaborative communication proposal.

Context Manager is responsible for providing the communication and the interaction between both P2P elements of the application: client and server. In the server side it deals with the matching and retrieval procedures whilst in the client side it presents the learning objects retrieved from the server. ***Object Sharing Manager*** manages the object sharing between applications and devices, wrap and unwrap objects and save and request objects. To enable the collaborative communication the ***Context Manager*** must be running on both devices: the client and the server.

Once communication is set out the *client's Context Manager* sends to the **server's Context Manager** a file with the *student's learning profile* (split in dimensions) and the *keywords* of student interests **(1)**. The *server's Context Manager* invokes the ***Matching Keywords*** **(2)** (subcomponent) which looks for *learning objects metadata* in the *LOM local repository*. The method seeks for learning objects which the metadata fields (*title*, *description* and *keywords)* match with the keywords send by the client. The method returns a set of ***learning object metadata (LO metadata)*** that fits with the *keywords*.

Considering only the learning objects' references got in the previous step, the *server's Context Manager* performs the next step based on the criterion *learning profile*. In the ***matching learning profile*** **(3)**, the dimensions of the student's learning profile (*Perception, Presentation Format and Student Participation*) are compared to the *Interactive* and *Learning Resources* fields of the *Educational category of LOM standard* (Table 1). Table 3 presents the binding between the fields of the LOM standard (describing the learning content – Table 1) and the students' Preference Categories (Felder-Silverman – Table 2). The method returns to the **server's Context Manager** a set of metadata that fits the dimensions of the *client's learning profile* and the ***LO metadata*** **(4)** and it sends these outcomes to the *client's Context Manager*.

Table 3 Link between the LOM fields and preferences categories.

LOM Field (Table 1)	Field Values(Table 1)	Profile Feature (Table 2)	Dimensions of Learning Profile (Table 2)
Educational - Interactivity	Active	Concrete	Perception
	Expositive	Abstract	
Educational - Learning Resource Type	Figure, Video, Film, and others	Visual	Presentation Format
	Text, Sound, and others	Auditory	
	Practical Exercise, Experiment, and others	Active	Student Participation
	Questionnaire and Readings	Reflexive	

As soon as *client's Context Manager* receives the *LO metadata* it invokes the ***LO references viewers*** **(5)** which shows to the student the available LOs according to the metadata retrieval (keywords, titles, media format, etc). When the students chooses one or more LO, the *client's Context Manager* sends the *selected LO references* to the **client's *Object Sharing Manager* (6).**

The *server's Object Sharing Manager* receives from the client the ***LO Identifiers*** **(7)**. The ***LO retriever*** retrieves the respective LO in the *LO local repository* **(8)**. After this, the *LO files* are wrapped by the ***LO wrapper*** **(9)** and sent by *server's Object Sharing Manager* **(10)** to the client. In the client, *LO files* are unwrapped and stored in a *LO local repository* and then cataloged the in a *LOM local repository*, respectively performed by ***LO Unwrapper*** **(11)** and ***LO Cataloger*** **(12)**. The client can provide the new LOs in a future collaborative communication.

3.3 The Validation's Approach

In order to supply the proposal approach in the validation process we developed a mobile application that allows users to download the learning objects, their respective metadata and the student's learner model previously registered from a cloud application, called Web Collaborative Learning (WCL). The student's learner model is composed of the keywords (stating his learning preferences) and his learning profile spitted into dimensions. By using the WCL, the user may look for learning objects in the Web, select ones that he has interests, and register the value of LOM field creating the LO metadata. The user's learning profile was extracted from the outcomes of the questionnaire of Soloman e Felder [11] that the user answered in his first access to WCL.

WCL application is hosted in an Amazon[2] cloud and uses the SQLite database 3.6.20[3]. Our mobile module connects to the cloud database and before the objects be downloaded to the mobile device it shows the description of the learning objects catalogued (LOM fields as title, media format, etc). The user chooses the learning objects and the mobile module performs the download, storing the objects and their metadata in a local repository. The user can also download from the cloud his learner model. After that, the user does not need the Internet infrastructure to connect and to share the learning objects with other devices.

We have implemented a prototype application of e-learning P2P in an Android platform based on the proposal model, simulating the communication in an emulator previously. After the first tests, we have run the application in two devices which support of Bluetooth API: Samsung Galaxy 5 (Android 2.1) and Motorola Milestone (Android 2.0). We used the Bluetooth API for implementing the functions of communication as forwarding messages, service names and routing.

Before starting the communication with the devices, we downloaded from the Amazon cloud a set of ten learning objects and their metadata to the Galaxy 5 and a set of seven learning objects to the Motorola. The learner model of the users is also downloaded. The learner model saved in Galaxy has the keywords *computer networking, mobile, cloud* and *android* and its *perception, presentation format* and *participation* dimensions have the follow values: *sensing, visual and active*.

As an example, we report an illustrative operation in which Galaxy is the client and Motorola is the server (Figure 2 shows the snapshots): **(a)** Galaxy finds Motorola and starts the communication; ***Context Manager of Motorola*** receives the

[2] http://aws.amazon.com/pt/

[3] http://www.sqlite.org/

keywords and the *learning profile* from ***Context Manager of Galaxy***; **(b)** after the matches process in the ***Context Manager of Motorola***, ***Context Manager of Galaxy*** receives *four* of seven available LOs that match to its learner model (*keywords* and *learning profile*), showing the options to the student. By selecting the *cloud computing* learning object, the ***Context Manager of Galaxy*** invokes its ***Object Sharing Manager*** that requests to the server the transference of the learning object; **(c)** the ***Object Sharing Manager of Motorola*** retrieves and wraps the *cloud computing* learning object, delivering it to the client. The ***Object Sharing Manager of Galaxy*** saves the object and its metadata, forwarding the object reference to its ***Context Manager*** that presents the learning object to the student. In Figure 2 we can observe the adhesion between the presentation format of the learning object (a picture) and the value of the student presentation format dimension (visual).

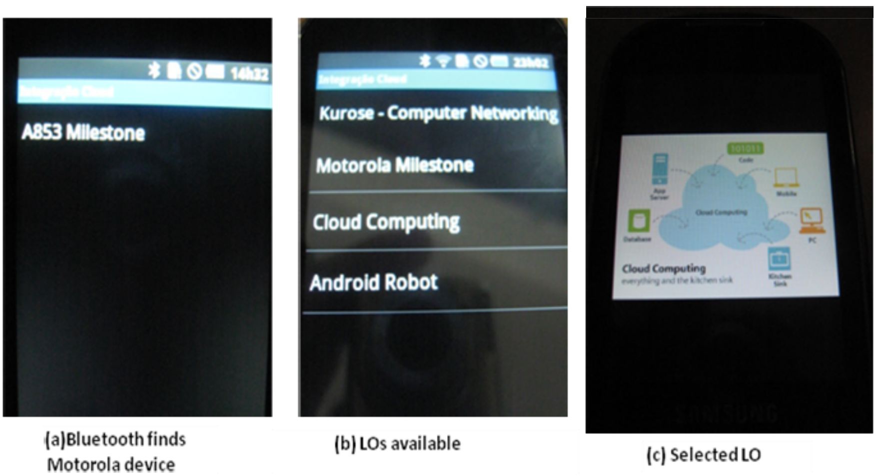

Fig. 2 Screen pictures of proposed approach in operation.

4 Related Works

There are e-learning application examples found in the literature that works with learning profile, learning objects and P2P communication. We focused in the follows which have relationship with our approach.

Felder and Silverman [5] proposed a model based on dimensions of learning and teaching styles, creating a relationship between learning styles and teaching strategies that can be used to support the students' learning styles. The authors argue that the learning style should be observed by four different behaviour dimensions. The model of Felder and Silverman aggregates a wider set of desirable features: simplicity, open and wide use, and online availability. Nonetheless, it has not proposed how to realize a dynamic linkage between the content and the profile.

Milošević et al. [12] proposed the adoption of a learning style that allows the system to build learning workplaces, bounding learning content and learning styles through the SCORM (Sharable Content Object Reference Model) [2]. Although this proposal adopts a standard to support the concept specification, it does not consider the learning profile according to dimensions.

EduSHARE [13] e-learning application proposes an e-learning application that allows the data sharing in a P2P communication between student and teacher, and student and student. The main feature is to support the feedback on understanding of what is being discussed in the class through questions sending to the student by the teacher. The student response may be sent to the other students sharing the impressions and doubts. Nevertheless, the proposal does not adopt standards to organize the data and learning profile to offer contents to the students.

Honey and Mumford's learning styles questionnaire was employed by Lowery [14]. The assessment phase was conducted with the offering of activities, and with the identification of students' styles. The author reports the problems in assisting some styles in disciplines with practical nature, bringing new challenges to future online lectures planning.

5 Conclusions and Further Works

In this work, we have raised up an approach that supplies the sharing and the exchanging of learning objects through a P2P collaborative communication, without usage of Internet infrastructure. The focus concerns in the student's learning profile and its linkage to learning objects for automatic content offering. To do so, we use the Felder-Silverman Learning Style Model along with the IEEE LOM standard, a combination proposal that, extending former works, can suitably relate learner profiles and learning objects, automatically, in different fields of learning, and consistently reflecting the intrinsic style of the students. We use a multiple-matching to select the learning objects according to two criteria: keywords and profile (style).

A prototype of our proposal was developed and experimented in two different mobile devices through Android platform. A mobile module, which connected to a cloud application database, was developed to aid users to download the proposal requirements (learning objects, metadata and learner model) data. This practice improved our experiment, allowing us to focus in our approach results. Another important point is that the cloud application (WCL) has allowed the students to catalogue various learning objects they have interest. However, it is not download into the device all the catalogued learning objects for reasons of storage space use.

Further works include adding new features to the matching process to consider other context elements beyond of learning profile. Such new features include student physical localization and device resources (memory, processor, screen size etc), features that must be considered when choosing the most adequate content. We are also interested in investigating the usage of different protocols to tranfer data such as protocol buffers[4] and thrift [5]. These protocols will enable the optimization of the exchange of data between the cloud and the devices and between the devices.

[4] http://code.google.com/p/protobuf/

[5] http://thrift.apache.org/

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References

1. Devedžic, V., Jovanovic, J., Gaševic, D.: The pragmatics of current e-learning standards. IEEE Internet Computing 11(3), 19–27 (2007)
2. Devedžić, V., Gašević, D., Djurić, D.: Clarifying the meta. International Journal of Information and Communication Technology 1(2), 148–158 (2008)
3. Zaina, L.A.M., Bressan, G.: Learning objects retrieval from contextual analysis of user preferences to enhance e-learning personalization. In: Proc. of IADIS International Conference WWW/Internet 2009, pp. 237–244 (2009)
4. Zaina, L.A.M., Rodrigues Jr., J.F., Cardieri, M.A.A.C., Bressan, G.: Adaptive learning in the educational e-LORS system: an approach based on preference categories. International Journal of Learning Technology 6(4), 341–361 (2011)
5. Felder, R.M., Brent, R.: Understanding Student Differences. Journal of Engineering Education 94(1), 57–72 (2005), doi: 10.1.1.133.171
6. Felder, R.M., Silverman, L.K.: Learning and Teaching Styles in Engineering Education. Journal of Engineering Education 78(7), 674–681 (1988), doi: 10.1.1.92.774
7. IEEE LOM, Draft standard for learning object metadata, `http://ltsc.ieee.org/wg12/index.html` (accessed June 25, 2009)
8. Jung, S., Lee, U., Chang, A., Cho, D., Gerla, M.: BlueTorrent: Cooperative Content Sharing for Bluetooth Users. In: IEEE PerCom 2007, White Plains, NY, March 19-23 (2007)
9. Vieira, V., Tedesco, P., Salgado, A.C.: Designing context-sensitive systems: An integrated approach. Expert Syst. Appl. 38(2), 1119–1138 (2011)
10. Cramer, H., Evers, V., Ramlal, S., Someren, M., Rutledge, L., Stash, N., Aroyo, L., Wielinga, B.: The effects of transparency on trust in and acceptance of a content-based art recommender. User Modeling and User-Adapted Interaction 18(5), 455–496 (2008)
11. Soloman, B.A., Felder, R.M.: Index of Learning Styles Questionnaire (1997), `http://www.engr.ncsu.edu/learningstyles/ilsweb.html` (accessed June 19, 2008)
12. Milošević, D., Brković, M., Debevc, M., Krneta, R.: Adaptive Learning by Using SCOs Metadata. Interdisciplinary Journal of Knowledge and Learning Objects 3(1), 163–174 (2007)
13. Angelaccio, M., Buttarazzi, B.: Adaptative Peer to Peer Data Sharing for Technology Enhanced Learning. In: Lytras, M.D., Ordonez De Pablos, P., Avison, D., Sipior, J., Jin, Q., Leal, W., Uden, L., Thomas, M., Cervai, S., Horner, D. (eds.) ECH-EDUCATION 2010. CCIS, vol. 73, pp. 425–430. Springer, Heidelberg (2010)
14. Lowery, C.: Adapting to student learning styles in a first year electrical/electronic engineering degree module. Journal of the Higher Education Academy Engineering Subject Centre 4, 52–60 (2009)

CAFCLA: A Conceptual Framework to Develop Collaborative Context-Aware Learning Activities

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Abstract. Advances appeared in Information and Communication Technologies along last years have given raise to new interaction ways between people and technology. Ambient Intelligences (AmI) is a multidisciplinary research area which promotes the use or technology in a transparent way to facilitate everyday tasks. Education is one field that benefits from AmI: collaboration between students in innovate ways, data acquisition from the context or real time location systems enhance learning processes. This paper presents CAFCLA, a framework aimed at designing, developing and deploying AmI-based educational scenarios where collaboration between students and contextual information are available every time and everywhere through multiple resources and communication protocols.

Keywords: Ambient Intelligence, Computer Supported Collaborative Learning, Context-aware Learning, Wireless Technologies, Real Time Locating Systems.

1 Introduction

In recent years there has been a technological explosion that has flooded our society with multiple and different technological devices. Similarly, devices improve their processing and storage capacity and storage, their user interfaces or their communication skills day by day. Thanks to these advances, we are currently surrounded by technology that has changed our habits and customs [1]. All this has given cause to appear fields such as Ambient Intelligence, whose main objective is to simplify the use of technology to improve the quality of life of users [2].

Education is one of the areas in which Ambient Intelligence presents a greater potential as it provides new ways of interaction and communication between individuals and technology systems [3]. The usage of Communication and Information Technologies (ICT) has been present in educational innovations over recent years [4], modernizing the traditional transmission of content through electronic

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