Learning Technology

publication of

IEEE Computer Society's

Technical Committee on Learning Technology (TCLT)

Volume 14 Issue 1 **ISSN 1438-0625** **January 2012**

From the Editors …

Welcome to the January 2012 issue of the Learning Technology newsletter on Adaptive and Intelligent Systems for Collaborative Learning.

This issue is edited by Guest Editor ***Prof. Demetriadis***, and includes articles from key experts and projects at a European level.

The issue also includes a section with regular articles (i.e. articles that are not related to the special theme).

We sincerely hope that the issue will help in keeping you abreast of the current research and developments in Adaptive and Intelligent Systems for Collaborative Learning. We also would like to take the opportunity to invite you to contribute your own work on technology enhanced learning (e.g. work in progress, project reports, dissertation abstracts, case studies, and event announcements) in this newsletter, if you are involved in research and/or implementation of any aspect of advanced learning technologies. For more details, please refer to the author guidelines at http://www.ieeetclt.org/content/authors-guidelines.

Special theme of the next issue: **Social Networks and Social Computing in Technology-Enhanced Learning**

Deadline for submission of articles: **March 15, 2012**

Articles that are not in the area of the special theme are most welcome as well and will be published in the regular article section.

Articles that are not in the area of the special theme are most welcome as well and will be published in the regular article section.

Editors

Sabine Graf
Athabasca University, Canada
sabineg@athabascau.ca

Charalampos Karagiannidis
University of Thessaly, Greece
karagian@uth.gr

Preface from the Guest Editor

This special issue of the IEEE Learning Technology Newsletter focuses on adaptive and intelligent systems for collaborative learning. The special issue includes six articles from respective research teams, which advance our current understanding of how to develop technological systems for collaborative learning that are more aware of and responsive to group learner needs. Most of these works have been funded either by the European Union (EU) or by national research funding programs and this duly highlights the interest that the field currently attracts and the opportunities that it offers.

The six contributions can be classified in two groups, depending on their specific focus. The first group includes two articles relevant to large scale projects: (1) Dragon, Yang and Mavrikis present the Metafora project, focusing on science and math learning and employing interaction analysis methods for providing feedback to learners; (2) Scheuer, Niebuhr, Dragon, McLaren and Pinkwart demonstrate the LASAD project with emphasis on online argumentation, offering tools for the flexible configuration of the collaborative workspaces while also providing to group learners adaptive feedback and support.

The second group includes the rest four articles where the authors report their latest research advances and contributions in the field: (3) Pérez-Sanagustín and Hernández-Leo present the 4SPPIces approach for modeling important factors conditioning the design of adaptive/intelligent systems for collaborative learning in blended settings; (4) Anaya and Boticario explore the impact of two different data mining techniques in their effort to timely assess students' collaborative activity; (5) Valcárcel, Rodríguez, and Moreno simulate the collaborative learning activity through their agent-based Explora tool and provide evidence on the efficiency of the collaborative approach as compared to the individual learning strategy; (6) Mangione and Caballé introduce a new type of Learning Object, called Collaborative Complex Learning Object, aiming to increase learner's engagement by providing learning experiences better suited to the preferences of the Millennial generation.

I would like to warmly thank all authors of articles in this special issue for their top quality contributions, which offer to the reader a deeper understanding of the current situation in this fast progressing research field.

Special thanks go to the Editors of the Newsletter for providing the opportunity to guest edit and present this special issue.

Stavros Demetriadis
Department of Informatics
Aristotle University of Thessaloniki
Greece
sdemetri@csd.auth.gr

Special Theme Section: Adaptive and Intelligent Systems for Collaborative Learning

Metafora: Defining and Supporting "Learning to Learn Together"

Introduction

The EU-funded Metafora project (http://www.metafora-project.org) is developing a computer-supported collaborative learning environment to enable 12 to 16-year-old students to learn science and mathematics by undertaking relatively complex collaborative challenges. The project combines both theory and technology in an effort to better engage students in a process referred to as "learning to learn together" (L2L2). During L2L2 process, learners must manage a variety of social and organizational challenges in addition to actively engaging in the learning activity. Throughout our efforts, we have identified high-level, crucial aspects of the L2L2 process, and certain lower-level behaviors that demonstrate competence in these key concepts. Accordingly, we seek to offer both a pedagogical approach and an intelligent software framework that can support these behaviors, and therefore the L2L2 process as a whole.

The Metafora platform

The system itself is a web-based framework consisting of loosely coupled, individual learning tools integrated with a unified interface and communication channels that allow the tools to interact and share information with one another. Through the basic functionality of the Metafora tools, we provide a space that allows for, and inherently promotes, the identified behaviors deemed important to L2L2. The tools include:

- Planning Tool (Figure 1), providing a visual language and graphical space for students to describe and reflect upon their group learning process.
- Discussion Tool (Figure 2), providing a graphical argumentation space where students can share and debate ideas and issues arising from their work.
- Exploratory environments, providing simulations or microworlds where students can solve problems and explore topics including mathematics, physics and environmental concepts.

Through intelligent analysis of the students' behavior within these tools — accomplished through interaction analysis of indicators, both within and across tools (Dragon, 2012) — we provide computer-based support to students whenever possible and promote increased awareness of crucial L2L2 activities for both students and teachers.

L2L2 in Metafora: Representative Examples of Theory and Support

In the Metafora context, once a group of learners is assigned to a shared challenge, they plan the key stages of their group learning first (Figure 1, green cards), and then specifically plan the activity processes involved in each stage (Figure 1, blue cards). These processes include the use of other Metafora tools, including the discussion and exploratory environments. From an educational theory standpoint, the group learning process dynamically proceeds and evolves in relation to the group's shared mental models. Cooke, Salas, Kiekel, & Bell (2004) introduced a useful distinction between two types of mental models, referred to as taskwork models and teamwork models. Taskwork mental models are representations of how particular cooperative or collaborative tasks should be accomplished. Teamwork mental models are representations about knowledge, skills, abilities, and availability of the team and its members. Both models play important roles in L2L2, so we now present examples of how each type of model is represented and supported within the Metafora environment.

In the Metafora context, group learners share taskwork models directly by creating plans in the planning tool. We have identified several behaviors considered important to L2L2 in the plan-creation process; including the use of divergence and convergence in plans to promote novel ideas and to distribute leadership. Students can intuitively acknowledge divergence by branching from individual nodes, and convergence by having multiple activity results feeding into a single activity (see Figure 1). The intelligent analysis system can directly support students by recognizing and providing feedback when a plan has no divergence, or diverges but does not — in a later stage — converge.

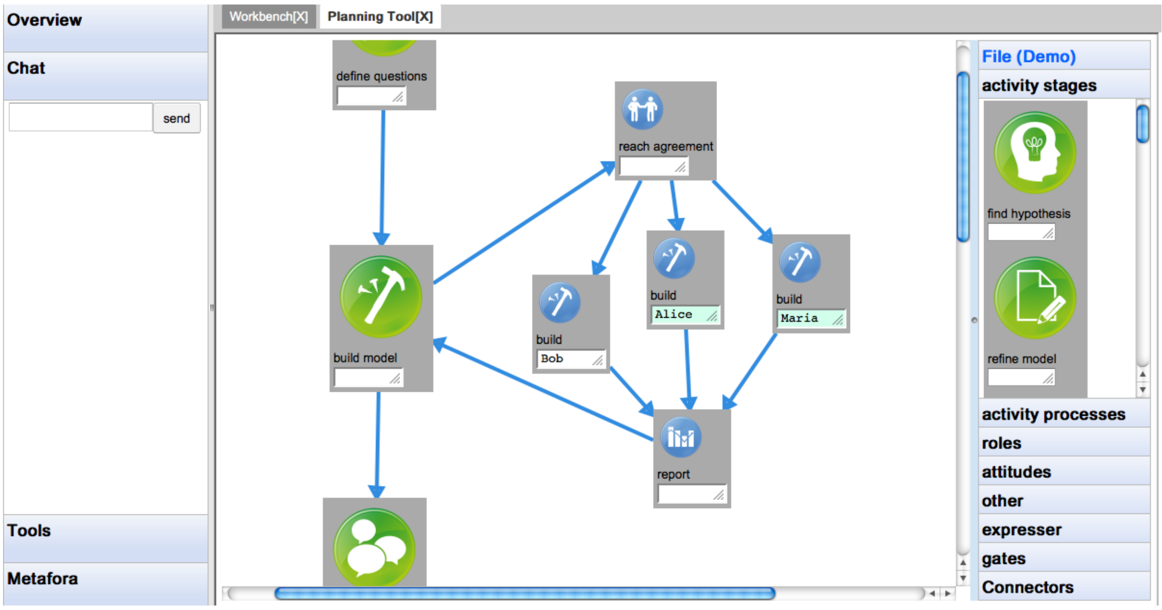


Figure 1: A section of a student plan demonstrating divergence (manifested by the different 'build' cards in parallel) and convergence (all students meet to 'report' on their work).

Developing teamwork mental models is also important during L2L2 activities. One specific application of the teamwork models is help-seeking and giving. Previous research emphasizes this behavior as an important element of self-regulated learning (Karabenick, 1988) without necessarily considering collaborative settings. Newman (1994) defines a general model of help-seeking that highlights the importance of several meta-cognitive skills related to help-seeking. Affective characteristics also come into play particularly because help seeking is regarded as a social transaction that takes place within an interpersonal relationship (Newman, 2000).

For a specific example, we consider a student struggling with a task and seeking help from a peer. Metafora encourages this type of help-seeking and help-giving behavior in order to develop learners' socio-metacognitive skills and particularly their ability to identify the individual differences amongst group members, and balance their individual help-seeking need with their group learning goals. In early pilot studies, students performed this task within the platform by sharing their constructions in a discussion space where they met with other students to attempt to resolve the issues encountered (see Figure 2). Several requirements have emerged from these pilots including the need to design methods of informing the student from whom help is requested, and providing context information about the struggling student. In addition, we seek to provide opportunities for students to better understand their peers' abilities and decide appropriately from whom to seek help when they are struggling. Automated support can be used to recognize when students are struggling and suggest appropriate peers for help-giving, alerting either teacher or students to these possibilities (Dragon, 2012). .

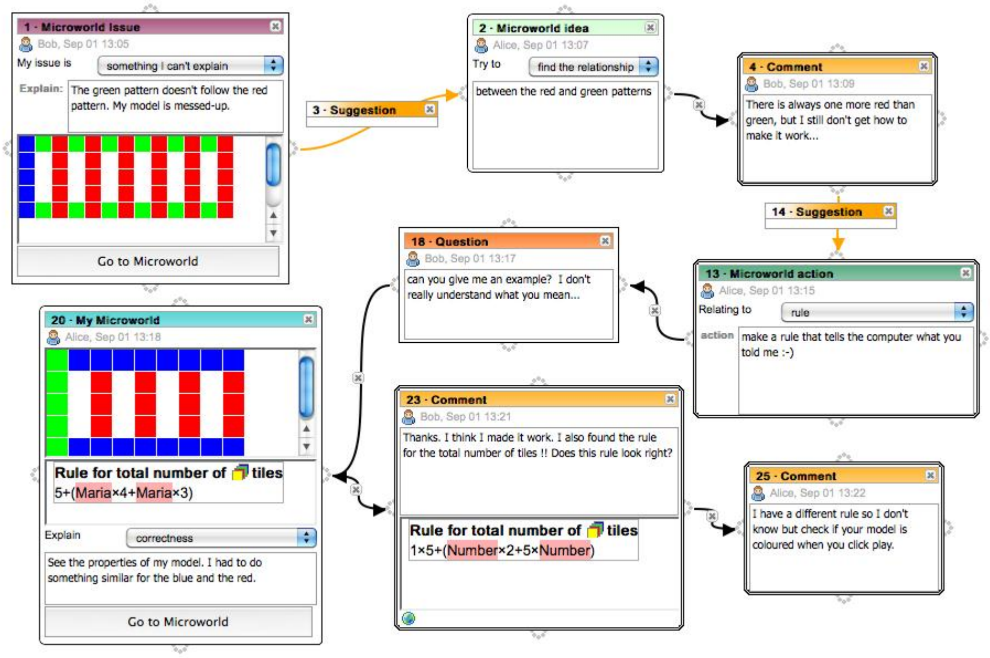


Figure 2: One student providing help to another student in reference to their work in a specific microworld.

Acknowledgments.

The European Union provided funding for this project under the ICT theme of the 7th Framework Programme for R&D (FP7).

References

Dragon, T., McLaren, B., Mavrikis, M., & Geraniou, E. (2012). Scaffolding Collaborative Learning Opportunities: Integrating Microworld Use and Argumentation. *Advances in User Modeling: Selected papers from UMAP 2011 Workshops* (pp. 18-30). Girona: Springer-Verlag.

Cooke, N. J., Salas, E., Kiekel, P. A., & Bell, B. (2004). Advances in measuring team cognition. In E. Salas & S. M. Fiore (Eds.), Team cognition: Understanding the factors that drive process and performance (pp. 83–106). Washington, DC: American Psychological Association.

Karabenick, S. A. (1988). Strategic Help Seeking Implications for Learning and Teaching. Lawrence Erlbaum Associates, NJ, USA.

Newman, R. S. (1994). Adaptive help seeking: a strategy of self-regulated learning. In Schunk, D. H. and Zimmerman, B. J., editors, Self-regulation of learning and performance: Issues and educational applications, pages 283–301. Hillsdale, NJ: Erlbaum.

Newman, R. S. (2000). Social influences on the development of children's adaptive help seeking: The role of parents, teachers, and peers. Developmental Review, 20: 350–404.

Toby Dragon
Saarland University, Germany
dragon@celtech.de

Yang Yang
University of Exeter, UK
Y.Yang@exeter.ac.uk

Manolis Mavrikis
London Knowledge Lab, UK
m.mavrikis@lkl.ac.uk

Adaptive Support for Graphical Argumentation – The LASAD Approach

In the past two decades, approaches to support argumentation learning through graphical representations have gained considerable attention, particularly in collaborative settings (Scheuer et al., 2010). In collaborative graphical argumentation, students create argument diagrams in a shared workspace; boxes represent statements and links represent argumentative or rhetorical relations between statements. The diagrams sometimes capture the argumentative structure of texts given to students, sometimes outline the lines of argumentation to help students prepare the writing of new texts, and sometimes represent structured discussions between students. Many reasons have been cited as to why graphical argument representations are beneficial for learning, e.g., they make argument structures explicit, encourage reflection on basic concepts of argumentation, reduce cognitive load, help systematically explore a space of debate, facilitate the evaluation of arguments, serve as resources and stimuli for discussions, and facilitate automated argument analysis (e.g., Suthers, 2003; Andriessen, 2006; Scheuer et al., 2010).

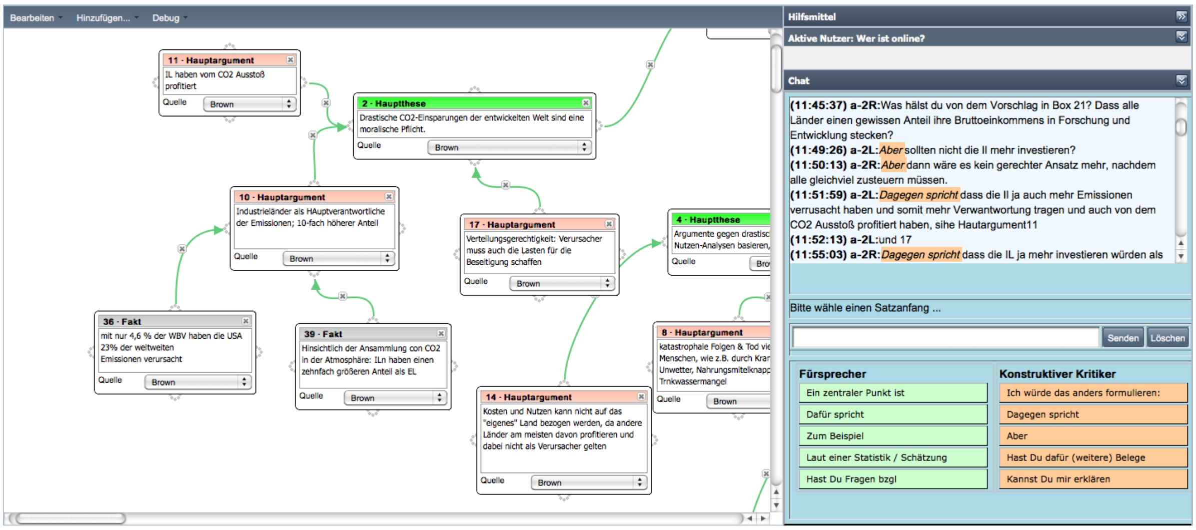


Figure 1: LASAD user interface: argument canvas (left) and sentence opener interface (right)

The LASAD project (Learning to Argue – Generalized Support Across Domains; http://cscwlab.in.tu-clausthal.de/lasad/) is motivated by the observation that graphical argumentation systems typically are not easily adapted to new requirements, since they tend to be tied to specific argumentation domains, visualizations, or collaboration modes. The LASAD system (Loll et al., in press), on the other hand, is a general, cross-domain framework that enables users (i.e., developers, teachers and researchers) to configure workspaces according to their specific requirements. Communication and task-related tools can be added to the workspace such as a text chat, a sentence opener interface, and a text display that allows linking of text passages to elements of the argument diagram. Boxes and links can be configured differently per application; labels, visual appearance, and subcomponents (e.g., text fields, radio buttons and dropdown menus) can be altered. A graphical administration and authoring system has been implemented and integrated with LASAD, allowing users to easily define and administer workspace setups, users and sessions. LASAD is purely web-based; a modern web-browser and web access is all that is required to use the system. Figure 1 shows a screenshot of LASAD.

One of LASAD's key features is its ability to provide adaptive feedback and support to students while they create argument diagrams. A configurable analysis service has been developed, one that receives notifications about user actions, and provides feedback in response. The analysis service uses production rules, specifically the Jess library within Java, to evaluate an evolving argument diagram. With author-specified configuration, the analysis service detects patterns in argument diagrams such as cyclic arguments, boxes that are connected through an incorrect link type, keywords in text fields, or important text passages that have not been considered in the diagram yet. Patterns can also include process characteristics such as actors and timestamps, e.g., to limit the result set to recently created sub-graphs, sub-graphs entirely created by one student or sub-graphs resulting from an interaction between multiple users. This approach builds on previous research that has shown that both structural and temporal characteristics can be important to define meaningful patterns (McLaren et al., 2010, Pinkwart et al. 2009). Feedback strategies are defined in XML files, including feedback text, highlighting of graphical pattern, and pattern priorities. Figure 2 shows a LASAD feedback message (in the window on top of the panel on the right) that has been provided in response to a detected pattern (the box highlighted red).

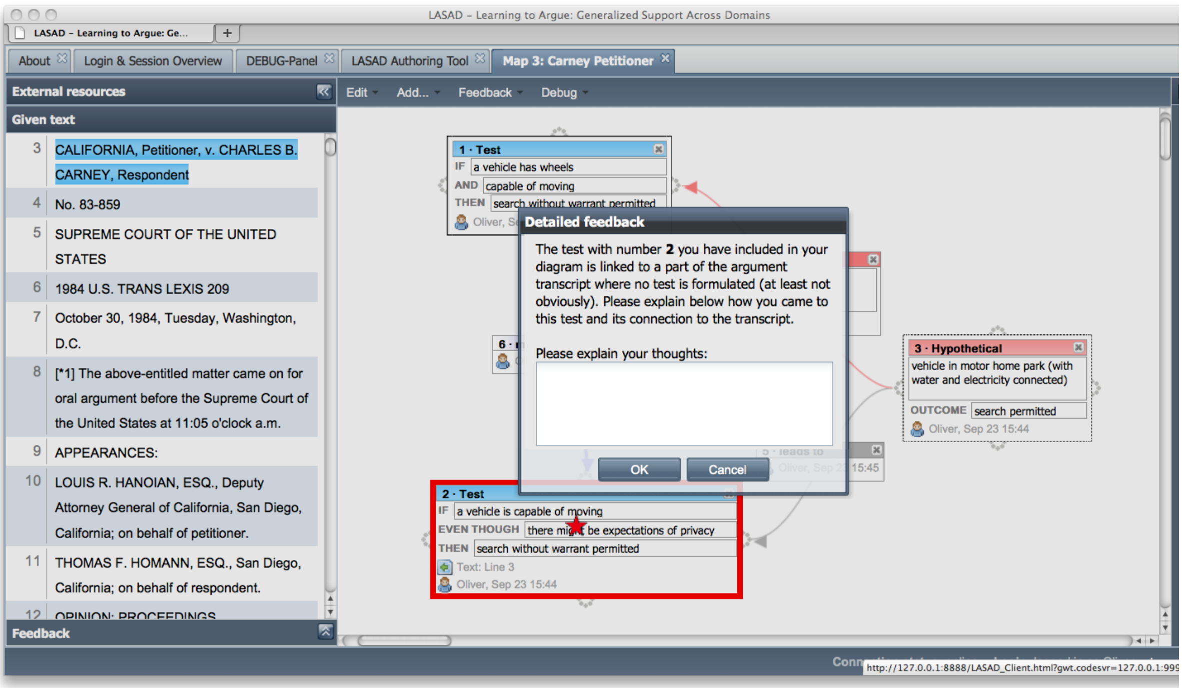


Figure 2: LASAD feedback provision

We are currently developing a graphical authoring tool to support administrators in the definition of patterns and feedback, similar to the way they are already supported in the definition of workspaces, boxes and links. The challenge is to find the right balance between expressiveness and ease of use. We are planning a first version that supports relatively simple patterns. In a second version, we will consider an additional expert mode, in which iterative patterns are also supported (e.g., sequences of undefined length). The general problem of detecting patterns in graphs is known to be NP-complete ("subgraph isomorphism problem"). It is therefore also important to keep runtime considerations in mind when specifying patterns. We are planning to analyze such complexity issues both from a theoretical and empirical angle, also considering specifics of the Rete pattern matching algorithm used in Jess, to determine boundary conditions for admissible and non-admissible patterns. The goal is to automate the complexity analysis to provide users with feedback regarding expected pattern search times when they define new patterns.

The flexibility of LASAD has been demonstrated through emulations of past systems in different domains such as scientific argumentation (Belvedere; Suthers, 2003), legal argumentation (LARGO; Pinkwart et al., 2009) and e-discussions about socio-scientific issues (ARGUNAUT; McLaren et al., 2010). It has been used in a number of studies to investigate research questions in computer-supported argumentation learning (e.g., Loll & Pinkwart, 2011). The system can be tested online for free (http://homer.in.tu-clausthal.de/lasad/).

Acknowledgements

The German Research Foundation (DFG) provided support for this research under the grant “LASAD – Learning to Argue: Generalized Support Across Domains.”

References

Andriessen, J. (2006). Arguing to Learn. In K. Sawyer (Ed.), *Handbook of the Learning Sciences* (pp. 443–459). New York: Cambridge University Press.

Loll, F. & Pinkwart, N. (2011). Guiding the Process of Argumentation: The Effects of Ontology and Collaboration. In M. Spada, G. Stahl, N. Miyake, N. Law (Eds.), *CSCL2011 Conference Proceedings Volume I* (pp. 296–303). Hong Kong: International Society of the Learning Sciences (ISLS).

Loll, F., Pinkwart, N., Scheuer, O., & McLaren, B.M. (in press). How Tough Should It Be? Simplifying the Development of Argumentation Systems using a Configurable Platform. To appear in: N. Pinkwart, N. & B. M. McLaren (Eds.), *Educational Technologies for Teaching Argumentation Skills.* Bentham Science Publishers.

McLaren, B.M., Scheuer, O., & Miksatko, J. (2010). Supporting collaborative learning and e-Discussions using artificial intelligence techniques. *IJAIED 20*(1), 1–46.

Pinkwart, N., Ashley, K.D., Lynch, C., & Aleven, V. (2009). Evaluating an Intelligent Tutoring System for Making Legal Arguments with Hypotheticals. *IJAIED 19*(4), 401–424.

Scheuer, O., Loll, F., Pinkwart, N., & McLaren, B.M. (2010). Computer-Supported Argumentation: A Review of the State of the Art. *IJCSCL 5*(1), 43–102.

Suthers, D. (2003). Representational Guidance for Collaborative Inquiry. In J. Andriessen, M. Baker, D. Suthers (Eds.), *Arguing to Learn: Confronting Cognitions in Computer-Supported Collaborative Learning Environments* (pp. 27–46). Dordrecht: Kluwer Academic.

Oliver Scheuer
Centre for e-Learning Technology
Saarland University, Germany
o.scheuer@mx.uni-saarland.de

Sabine Niebuhr
Department of Informatics
Clausthal University of Technology, Germany
sabine.niebuhr@tu-clausthal.de

Toby Dragon
Centre for e-Learning Technology
Saarland University, Germany
toby.dragon@celtech.de

Bruce M. McLaren
Centre for e-Learning Technology, Saarland University, Germany
Human-Computer Interaction Institute, Carnegie Mellon University, U.S.A.
bmclaren@cs.cmu.edu

Niels Pinkwart
Department of Informatics
Clausthal University of Technology, Germany
niels.pinkwart@tu-clausthal.de

4SPPIces: Factors in the Design of Adaptive and Intelligent Systems for CL Scripts Blending Spaces

Introduction

Several Adaptive and Intelligent Collaborative Learning Systems (AICLS) have been developed in the CSCL domain [3] to solve problems commonly related to collaborative learning practices [2, 4]. However, current AICLS lack of support for integrated structured activities flows conducted in several spaces beyond the classroom, the Computer Supported Collaborative Blended Learning (CSCBL) scripts [5]. Factors such as the spatial location where activities are conducted or the interplay between these activities condition collaboration and, consequently, the design of the AICLS to support CSCBL scripts. We present 4SPPIces, a model that identifies 4 factors conditioning the design of AICLS for blended settings and show how they are combined to implement 4 illustrative AICLS.

4SPPIces factors

4SPPIces defines 4 factors [5] (Fig. 1): (1) the ***S***pace, which defines the planned environment *where* learning activities are going to take place, (2) the ***P***edagogical method, that defines a learning flow, (3) the ***P***articipants, which defines the people involved in the activity and their characteristics and (4) the H***i***story, which models those aspects from the other factors likely to be affected by the unpredictable variations usually produced during the scripts enactment.

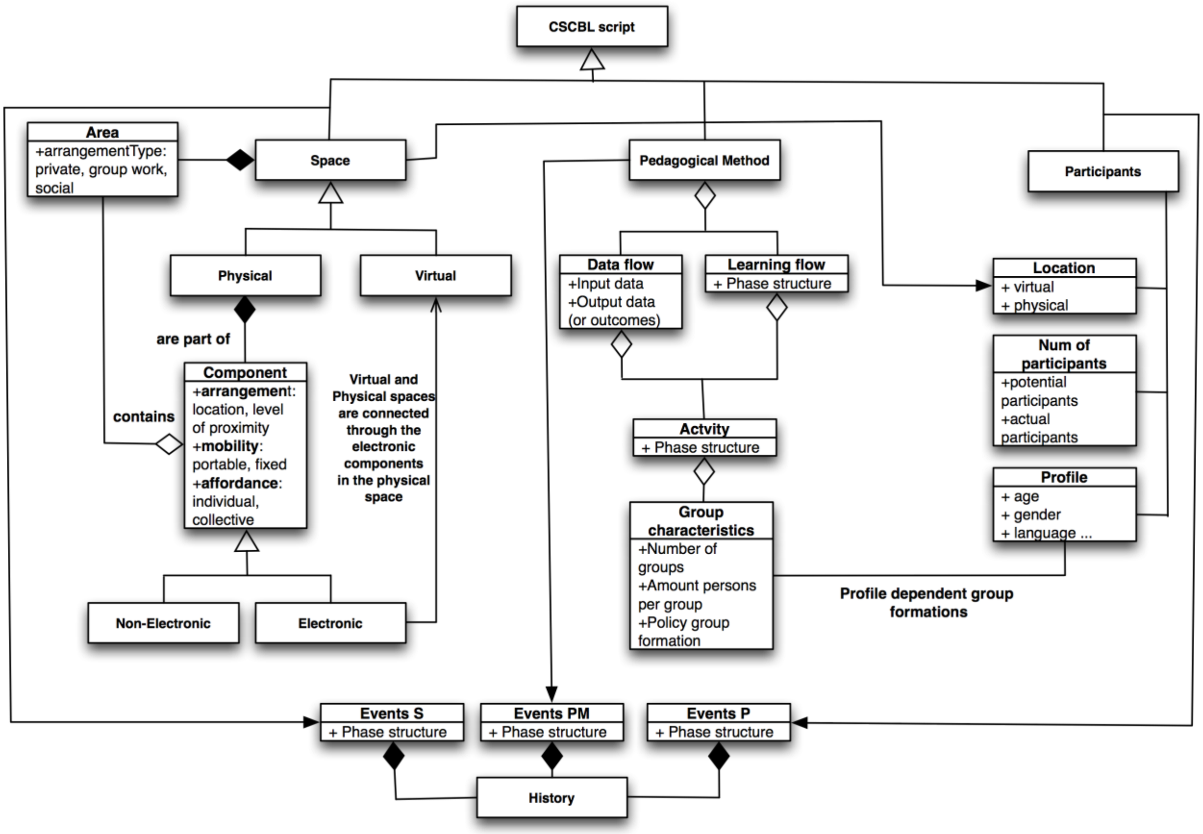


Figure 1 The 4SPPIces factors with their facets and inter-relations: the Space, the Pedagogical method, the Participants and the History.

Applications of the 4SPPIces factors in illustrative AICLS

Four AICLS considering combinations of the 4SPPIces factors have been implemented and evaluated in user and case studies (Fig. 2).

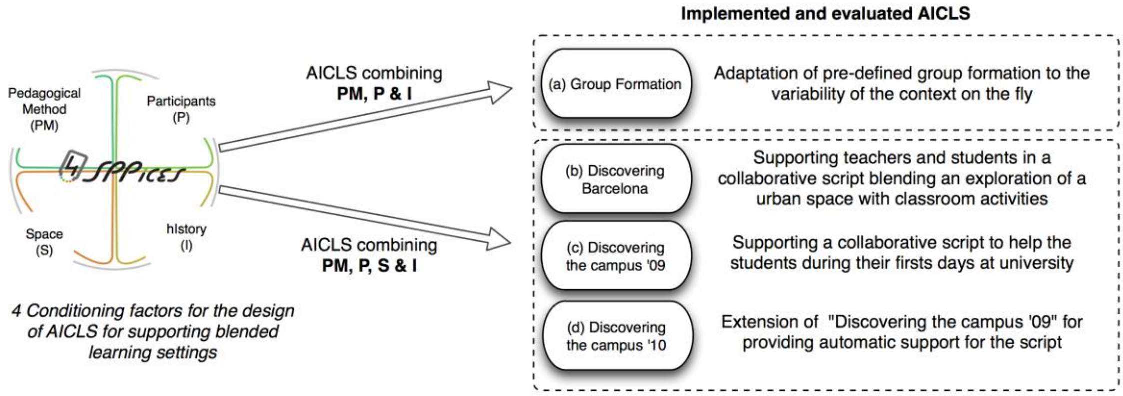


Figure 2 Summary of implemented and evaluated illustrative AICLS considering combinations of the 4SPPIces factors.

The first system supports the adaptation of pre-defined group formation to the variability of the context once the activity has started [7] (Fig. 2 (a)). This AICLS is designed considering: (1) the PM factor, represented by a collaborative learning flow pattern codified with IMS Learning Design; (2) the P factor, controlling the lists of students expected before the class and those actually attending each activity; and (3) the I factor, implemented as a *constraint controlled module* that considering the characteristics of the PM and (the eventually changing) P factor adapts and suggest the optimal group distribution on the fly.

The second AICLS proposes supports teachers and students in a collaborative script that combines an exploration of an urban space with classroom activities [5] (Fig. 2 (b)). This AICLS considers the 4 factors and is implemented as a combination of tools: the Moodle Learning Management System (LMS) for indoor activities and QuesTInSitu with mobile phones for outdoors activities. The PM is divided into two phases: an exploration of the city and a presentation in class. QuesTInSitu is used to create geo-located questions organized in routes which are automatically triggered to the students via mobile phones [8]. The P is the list of students registered in Moodle and QuesTInSitu. The S is the map of Barcelona city with the questions routes and the classroom. The I is represented with a monitoring functionality in QuesTInSitu for the teachers to follow in runtime where the students are located during the exploration.

The third AICLS supports a collaborative script to help students during their first days at university [6] (Fig.2 (c)). The AICLS considers all 4SPPIces factors and is implemented combining: (1) mobile devices with a Radio Frequency Identification (RFID) tags reader, (2) Moodle and (3) GoogleDocs. The PM is divided into three phases: (1) an exploration of the campus in which students access with mobile phones to the information hidden on 46 RFID tags distributed around the campus, (2) an activity in expert groups to prepare a presentation about a campus area and (3) an individual questionnaire in Moodle. The P models the profile of the students, defined by their expertise on a campus area. The S is the campus areas, the classroom and home. The I models the log-files that collect the actions of the participants (P) around the campus (S). Students become experts on an area depending to their actions in the exploratory activity and are grouped accordingly.

The fourth implementation extends the third AICLS so as to provide complete automatic support of the script [1] (Fig. 2 (d)). The PM is represented in IMS Learning Design and enacted using the Generic Service Integration (GSI) system, to administer students data (e.g., mobile phone log files) and automatically create groups by manipulating a Google on-line spreadsheet integrated with the LMS.

Conclusions

This work offers insights on how designers and researchers can address the design of AICLS for supporting collaborative scripts blending spaces. We presented 4SPPIces as a model that points out the critical factors to be considered in these designs and four AICLS worked-examples. The results from evaluating these AICLS indicate that they successfully support and facilitate teachers' and students' tasks during the scripts enactment [5, 6, 7].

Acknowledgements

This work has been partially funded by the Spanish Learn 3 (TIN2008-05163/TSI) and EEE projects (TIN2011-28308-C03-03).

References

[1] de-la-Fuente-Valentín, L., Pérez-Sanagustín, M., Santos, P., Henández-Leo, D., Pardo, A., Blat, J. & Delgado-Kloos, C. (2010) System orchestration support for a flow of blended collaborative activities, 2nd International Conference on Intelligent Networking and Collaborative Systems, Thessaloniki, Greece.

[2] Dillenbourg, P. (2002) Over-scripting CSCL: The risks of blending collaborative learning with instructional design, In Kirschner, P. A. (Ed.) Three worlds of CSCL. Can we support CSCL?, pp. 61-91.

[3] Magnisalis, I., Demetriadis, S. & Karakostas, A. (2011) Adaptive and Intelligent Systems for Collaborative Learning Support: A Review of the Field, IEEE Transaction on Learning Technologies, 4(1), pp 5-20.

[4] Ounnas, A., Davis, H. C. & Millard, D. E. (2009) A Framework for Semantic Group Formation in Education, Educational Technology & Society, 12 (4), pp. 43–55.

[5] Pérez-Sanagustín, M., Santos, P., Hernández-Leo, D. & Blat, J. (in press). 4SPPIces factors: a case study of factors in a scripted collaborative-learning blended course across spatial locations, International Journal of Computer Supported Collaborative Learning, doi: 10.1007/s11412-011-9139-3.

[6] Pérez-Sanagustín, M., Ramírez-Gonzalez, G., Hernández-Leo, D., Muñoz-Organero, M., Santos, P., Blat, J. & Delgado Kloos, C. (2010) Discovering the Campus Together: a mobile and computer-based learning experience, Journal of Network and Computer Applications, 35(1), pp. 176-188.

[7] Pérez-Sanagustín, M., Burgos J., Hernández-Leo D. & Blat J. (2011) CLFP intrinsic constraints-based group management of blended learning situations, In: Daradoumis T.; Caballé S.; Juan A.; Xafa F.; (Ed.) Technology-Enhanced Systems and Adaptation Methods for Collaborative Learning Support, Series "Studies in Computational Intelligence", 350, Springer: Verlag, pp. 115-133.

[8] Santos, P., Pérez-Sanagustín, M., Hernández-Leo, D. & Blat, J. (2011) QuesTInSitu: From tests to routes for assessment in situ activities, Computers & Education, 57(4), pp. 2517-2534.

Mar Pérez-Sanagustín
Telematics Department, Universidad Carlos III de Madrid
Madrid, Spain
mmpsanag@it.uc3m.es

Davinia Hernández-Leo
ICT Department, Universitat Pompeu Fabra
Barcelona, Spain
davinia.hernandez@upf.edu

Comparing two Data Mining Approaches to Timely Assess the Students Collaboration

Introduction

Studies argued that collaboration assessments improve the collaboration behavior and increase the student motivation [1]. However, providing tools to collaborate does not ensure collaboration. Frequent and regular analysis of students' interactions is needed to discover whether collaborative learning takes place [2].

Some researchers have shown that machine learning (ML) techniques can be applied in e-learning environments to obtain students' assessments [3] in a regular and frequent way. Their approach is based on applying data mining (DM) processes on collected data from students' interactions so that ML algorithms make predictions on students' performance and collaboration [4, 5].

We have proposed two different approaches, the Clustering approach [6] and the Metric approach [7], which proved that quantitative collaboration analysis supports timely student collaboration assessments. However, these approaches have not been used together in the same collaborative activity (CA) within a given e-learning course. In this paper we introduce the new CA, where both approaches will be compared.

Experiment

We have proposed a long-term CA divided into two phases where the students of the Artificial Intelligence and Knowledge based Engineering subject at UNED were invited to participate during the academic years 2006-07, 2007-08, 2008-09 and 2010-11 [6]. The CA was divided into two phases: the shorter, initial, introductory and individual phase; the longer, where three-member teams worked together and communicated through forums. We have investigated two data mining (DM) approaches to assess collaboration and valuable outcomes from the modeling viewpoint are described elsewhere [8]. Both approaches use student information on collaboration and student interactions in forums as their data source and each of them is based on different ML techniques. First, the clustering approach is based on a ML clustering algorithm that groups students according to their active interactions, which relate to the students activity and activity caused by students. Here students are grouped into three categories: high collaborative level, medium collaborative level or low. Second, the metric approach is based on decision tree algorithms to measure student collaboration from their interactions, which relate to regularity of student activity and initiative and student acknowledgment from their fellow-students. This approach provides a numerical student collaboration metric value instead of the aforementioned categories.

In our new CA we are investigating over the longer collaborative phase the effects on using both DM approaches to assess student collaboration. We are supporting students with a metacognitive tool that displays information about students' personal and contextual information, including collaboration assessment indicators on themselves and their team mates. The purpose here is to provide students with suitable information so that they are able to regulate their own collaboration process and improve their collaborative learning.

Collaboration assessments are displayed using a metacognitive tool, which is divided into two sections according to the two aforementioned DM approaches. The first section shows collaboration assessment indicators provided by the clustering approach, which includes: (1) average level of team collaboration, (2) a link for every member to see their personal collaboration level, and (3) a warning if there is undesirable teamwork (i.e. high variance among team members' collaboration levels or their average collaboration level is low). The second section displays the same features but provided by the metric approach. In particular it shows a warning when the average collaboration value is low or the variance is high.

To check the usefulness of provided tools, CA students are divided into four groups. The first group has access to the information displayed from the two approaches. The second has access just to the first of the aforementioned tool sections. The third group has access only to the second section. The fourth group is the control group, i.e., oblivious to collaboration assessments.

Once the CA is ended, students are provided with the final evaluation questionnaire, where their collaborative work is assessed. Later the students take the subject final exam. With all these data the metacognitive tool and the assessments provided by the two different DM approaches are evaluated and compared to each other. Expected outcomes are to confirm which DM approach is more valuable in terms of students' valorization and learning impact.

References

[1] K. Swan, J. Shen, S.R. Hiltz, Assessment And Collaboration In Online Learning. Journal of Asynchronous Learning Networks, Vol. 10, No. 1., pp. 45, 2006.
[2] D.W. Johnson, R. Johnson, Cooperation and the use of technology, In D. Jonassen (Ed.), Handbook of research on educational communications and technology, 785-812, 2004.
[3] C. Romero, P.G. Espejo, A. Zafra, J.R. Romero, S. Ventura, Web usage mining for predicting final marks of students that use Moodle courses, Computer Applications in Engineering Education, doi: 10.1002/cae.20456, 2011.
[4] E. Gaudioso, M. Montero, L. Talavera, F. Hernandez-del-Olmo, Supporting teachers in collaborative student modeling: A framework and an implementation, Expert Systems with Applications, 36 (2009), 2260–2265.
[5] D. Perera, J. Kay, K. Yacef, I. Koprinska, Mining learners' traces from an online collaboration tool, Workshop Educational Data Mining, Proceedings of the 13th International Conference of Artificial Intelligence in Education. Marina del Rey, CA. USA. July 2007, pp. 60-69.
[6] A.R. Anaya, J.G. Boticario, Application Of Machine Learning Techniques To Analyze Student Interactions And Improve The Collaboration Process, Special Issue of Expert Systems with Applications on Computer Supported Cooperative Work in Design. Vo. 38 No. 2, Feb 2011.
[7] A.R. Anaya, J.G. Boticario, Ranking Learner Collaboration according to their Interactions, The 1st Annual Engineering Education Conference (EDUCON 2010), Madrid, Spain, IEEE Computer Society Press 2010, pp. 797-803.
[8] A.R. Anaya, J.G. Boticario, Content-free Collaborative Learning Modeling Using Data Mining, User Modeling and User-Adapted Interaction (UMUAI): Special Issue on Data Mining for Personalized Educational Systems, Vol 21 (1-2), 2011, 181-216.

Antonio R. Anaya
Artificial Intelligence Department
E.T.S.I.I., UNED
Madrid, Spain
arodriguez@dia.uned.es

Jesús G. Boticario
Artificial Intelligence Department
E.T.S.I.I., UNED
Madrid, Spain
jgb@dia.uned.es

Using an Intelligent Agent based Platform to simulate Learning Processes

Introduction

In the latest years, e-learning platforms [1] provide users capabilities to collaborate on-line, which improve the learning processes [2]. Collaborative work among students is very important because it stimulates learning, increases motivation, creativity and personal satisfaction [3].

This paper addresses the evaluation of collaborative work using distributed simulation software based on intelligent agents [4] that solve labyrinths. The labyrinth is used as a metaphor of the work done by students during an academic course, where each tile is a particular activity and the whole labyrinth represents the complete learning sequence. The agents interact to solve the labyrinth in the same way than students do to complete the course.

The simulation has been done using a tool called “Explora”, which pursues three main goals:

1. To built a Distributed Multiagent Platform that provides support to study the learning process.
2. To analyze the obtained results and show that collaboration among students improves the searching process within the labyrinth.
3. To obtain the optimum number of students that collaborate, taking into account the kind of search, the labyrinth topology or its wideness.

Experiments Description

This paper addresses the study of collaborative work among students using labyrinth as a metaphor of the learning process, where:

- Each intelligent agent (or explorer) stands for an individual student. The behavior of these agents can change among experiments: they can collaborate or not.
- The labyrinth (or map) describes the sequences of learning activities that must be done by the student in order to pass the course (or, in the metaphor, find the exit).
- The tile represents each of the particular goals or activities the students must accomplish.
- The crosses represent the different decisions the student must take.

The experiments consist on different tests, each of them with particular settings: type, size and topology of the labyrinth, number of agents, etc.

The type of labyrinth tries to show different ways of passing a course. Some subjects introduce a sequential learning process while others permit parallel activities, or different ways of achieving the same goals. Figure 2 shows the different types of labyrinth; two particular kinds can be identified:

- “Perfect” labyrinth, where there is only a path between two tiles and there are not inaccessible tiles or loops. This kind of map stands for sequential and fixed learning processes.

- "Imperfect" labyrinth has loops with a fixed probability, which can be changed. They try to represent more flexible learning processes, which allow parallel activities and different learning paths.

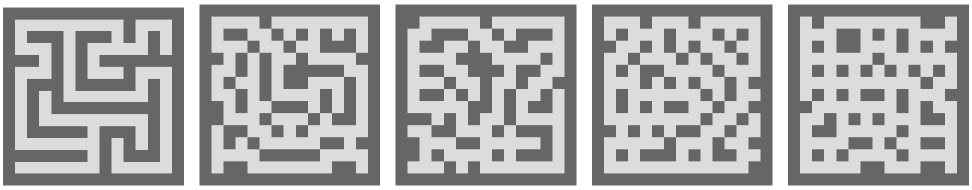


Figure 2: Labyrinth types, from left to right: perfect, imperfect (prob.=0, prob.=5, prob.=20, prob.=100)

Tool description

The experiments have been made using a tool specifically created. This tool has been made using intelligent agents as the basic concept for its design and implementation. The final product obtained has been a distributed Web Application (Figure 3), which is available on-line [5].

Figure 3: Explora web application

Results and Discussion

During the experimentation 21.580 simulations, which cover all the combinations of settings (kind of labyrinth, collaborative or non collaborative agent, number of agents, etc.), have been made. They have been grouped in 14.300 tests that share the same settings. For each simulation, the number of movements made by the agents to find the exit has been counted.

Figure 4 shows that the movements (in average) made by agents decreases when the number of explorers grows (in case of collaborative explorers) while it remains unchanged when the explorers do not collaborate. The basic line called minimum shows the minimal number of movements for finding the exit with an optimal algorithm. As it can be seen, this minimum is not reached in any case.

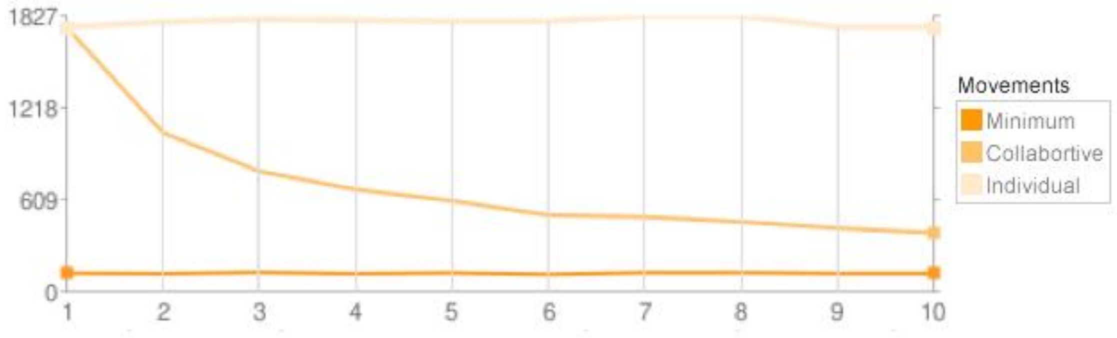


Figure 4: Average of the number of movements done by agents, taking as basis the minimum number

Next table, details the difference among collaborative and individual agents. This clearly shows that the number of movements does not change in the case of individual agents. Nevertheless, when using collaborative agents, the number of movements is reduced a 44% using two agents, and 60% in case of three. The table also shows that the increment is not linear, and the best results are using 3-4 agents. The improvements reduce drastically from 6 agents on.

Number Explorers	Movements			Extra Movements		Improvement		Increased improvement
	Minimum	Collab	Indiv	Collab	Indiv	Collab	Indiv	
1	123	1751	1751	1328%	1328%	0,0%	0,0%	0%
2	118	1052	1785	791%	1412%	620,8%	44,0%	44,0%
3	127	797	1803	527%	1317%	790,3%	60,0%	16,0%
4	118	676	1796	473%	1423%	949,9%	66,8%	6,8%
5	124	601	1789	384%	1343%	958,6%	71,4%	4,6%
6	113	506	1790	350%	1490%	1140,6%	76,5%	5,2%
7	126	496	1827	292%	1345%	1053,1%	78,3%	1,8%
8	125	463	1827	269%	1356%	1087,3%	80,2%	1,9%
9	121	421	1750	249%	1351%	1101,9%	81,6%	1,4%
10	120	390	1750	225%	1360%	1134,6%	83,4%	1,9%

Other experiments have addressed the relevance of the typology of map and the search algorithm in the number of movements, and have shown that there is not a significant influence in the results.

Conclusions

The results obtained conclude that collaboration among students leads to quicker learning when compared to individual learning. Three or four students will be the best number to learn in a group.

Results also have shown that other aspects such as the type of learning or the particular subject are not relevant for the collaborative issues.

In addition, a new tool for collaborative learning is under construction. This tool will allow defining behavior patterns that can be used as a way of guiding the students to the achievement of particular goals.

References

[1] Peña, C. I., Marzo, J. L., & de la Rosa, J. L. (2003). Intelligent agents in a teaching and learning environment on the web. In ICALT2002. Kazan, Russia: IEEE
[2] Akhtar, S., & Wyne, M. F. (2006). Distance learning education using the web. In MATH'06: Proceedings of the 10th WSEAS international conference on applied mathematics (pp. 565–571). Stevens Point, Wisconsin, USA.
[3] Plantamura, P., Roselli, T., & Rossano, V. (2004). Can a CSCL environment promote effective interaction. In ICALT'04: Proceedings of the IEEE international conference on advanced learning technologies (ICALT'04) (pp. 675–677). Washington, DC, USA: IEEE Computer Society.
[4] Russell , S., & Norvig, P. (2009). Artificial Intelligence: A Modern Approach. Pearson.
[5] Explora tool: http://193.147.87.91/explora

David Ramos Valcárcel
Dept. Lenguajes y Sistemas Informáticos
ESEI-Universidad de Vigo, Vigo, España
david@uvigo.es

Alma Gómez Rodríguez
Dept. Lenguajes y Sistemas Informáticos
ESEI-Universidad de Vigo, Vigo, España
alma@uvigo.es

Juan Carlos González Moreno
Dept. Lenguajes y Sistemas Informáticos
ESEI-Universidad de Vigo, Vigo, España
jcgmoreno@uvigo.es

New Approaches for Learning in the Millennial Generation: Collaborative Complex Learning Objects

Introduction

Educators in the Digital Age must understand the learner style of a new generation of teaching audience. The majority of today's students fall into the generational group called Millennials [1] (a.k.a. NextGen, GenY, C Generation, M Generation, and Echo Boomers), the generation born 1979 through 2000. They are a new generation of impatient, experiential learners, digital natives, multitaskers, and social embedded who love the flat, networked world and expect nomadic connectivity [2].

By understanding the Millennial student and how they learn, the educator is more successful in creating a learning centered environment. Such students prefer inductive reasoning, desire frequent and quick interactions with content, and display exceptional visual-literacy skills [3], all essential when navigating the digital technology used today. Digital natives [4] approach learning as a plug-and-play experience. They use the social context for enjoyment, challenge, and learning together. Viewing interactivity as a key component of technology-based learning activities, they expect those types of activities in their college classrooms. Today's students simply plunge in and learn through peer reflection and active participation. Millennials want more learning in realistic contexts as well as simulated environments and the use of more non-linear texts.

The literature [5] observes that Digital Age students express a need for more varied forms of communication, and report being fluency in (social) media use and easily bored with traditional learning methods. In the same way, Millennials need self-directed learning opportunities, interactive environments, multiple forms of peer feedback and assignment choices that use different resources to create personally meaningful learning experiences. Millennials want more hands-on, inquiry-based approaches to learning and are less willing simply to absorb what is put before them [6]. These learners want to construct their knowledge and they want to immediately engage in the process.

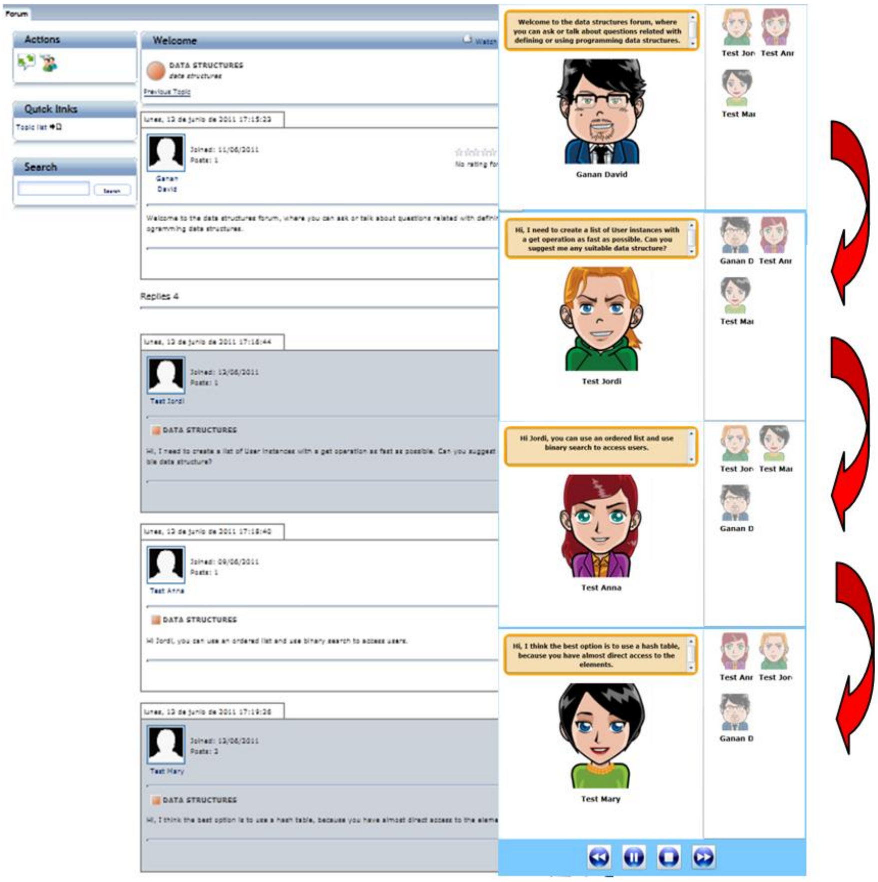
A New Approach for Digital Learners

The field of educational technology considers the research of news models and the experimentations of news methods as the major challenge for educational designers. How can educators reach the Millennial students and provide a productive and engaging learning environment? Social and collaborative learning [7][8] is one of the most successful forms used to get students to be responsible for their own learning and maximize the knowledge from peers and social feedback. This enables them to interact with course-mates, sharing their ideas and supporting each other in the way they learn.

However, traditional social and collaborative learning approaches cannot be applied in every e-learning experience because they require people's presence and/or collaboration is many times difficult to achieve. In addition, learning systems often lack of challenging resources and tools to support socialization and collaboration, making the learning experience unattractive, which discourages progression. Although the learner expects to control the learning experience, often is the learning experience that controls and limits the learner. As a result, learning resources lack of collaboration, authentic interactivity, social identity, and user empowerment and challenge, thus having a negative effect on learner motivation and engagement.

Collaborative Complex Learning Objects

The above deficiencies and limitations have been addressed by a new type of Learning Object (LO) [9] called Collaborative Complex Learning Object (CC-LO) embedded into a Virtualized Collaborative Session (VCS) [10]. A VCS is a registered collaboration session augmented by alternative flows, additional content, assessment, emotional state, etc., during an authoring phase (subsequent to the registration phase) to enrich the learning experience provided by the VCS. For instance, assessment scenes are added in certain points of a discussion where the learner is asked about the topic discussed so far, and according to the given answer, the learner can jump to different points of the discussion. The VCS can be interactive and animated (by movies or comic strips) and learners can observe how knowledge is constructed, refined and consolidated (see next figure).



Sequence of snapshots of a CC-LO evolving over time after the virtualization of a live collaborative session. Four contributions of the text-based discussion are converted by the VCS system into an animated storyboard supported by a text-to-voice engine

Overall, the VCS transforms a live discussion forum into an animated storyboard and produces an event in which CC-LOs are played and consumed by learners, sessions evolve ("animate") over time, and the ultimate end-user interactions with CC-LOs are handled. As a result, the VCS becomes an attractive learning resource so that learners become more motivated and engaged in the collaborative activities. The VCS containing the CC-LOs is eventually packed and stored as learning objects for further reuse (e.g., as learning video materials accessible from the classrooms) so that individual learners can leverage the benefits from live sessions of collaborative learning enriched with high quotes of interaction, challenge and empowerment.

Conclusions

This approach considers the virtualization of collaborative learning by reusing the knowledge elicited during live collaborations, with the aim to improve the learner's engagement, in terms of real interaction and empowerment of the collaborative experience from attractive and challenging learning resources. This provides a significant step forward in the development of current social and collaborative systems for e-learning in the Digital Age.

Acknowledgements

This work has been supported by the European Commission under the Collaborative Project ALICE ”Adaptive Learning via Intuitive/Interactive, Collaborative and Emotional System”, VII Framework Programme, Theme ICT-2009.4.2 (Technology-Enhanced Learning), Grant Agreement n. 257639.

References

[1] Bartlett, M. (2005). Generation X? So old school. The emphasis now is on the 'Millennials.' Credit Union Journal.
[2] Sweeney, R. (2006), Millennial Behaviors and Demographics. University Librarian, New Jersey Institute of Technology.
[3] Black, Alison. 2010. Gen Y: Who They Are and How They Learn. Educational Horizons, 88(2), 92-101.
[4] Prensky, M. (2006). Listen to the Natives. Educational Leadership 63 (4): 8–13
[5] Oblinger, D. G., and J. L. Oblinger, eds. 2005. Educating the Net Generation. Washington, D.C.: EDUCAUSE.
[6] Barnes, K., Marateo R., Ferris, S. (2007). Teaching and learning with the net generation. Innovate 3(4).
[7] So, H. & Brush, T. (2008). Student perceptions of collaborative learning, social presence and satisfaction in a blended learning environment: Relationships and critical factors. Computers & Education, 51(1), 318-336.
[8] Dillenbourg P. (1999). Collaborative –learning: Cognitive and Computational Approaches. Advances in Learning and Instruction Series. New York, NY, Elsevier Science Inc.
[9] Wiley, A. D. (2001). Connecting learning objects to instructional design theory: A definition, a metaphor and a taxonomy. In D. A. Wiley (Ed.), The instructional use of learning objects. Assiciation for Educational Communications and technology.
[10] Caballé, S., Mora, N., Dunwell I., Gañan, D. (2011). CC-LO: a New Type of Learning Object for the Virtualization of Live Collaborative Sessions. In proceedings of the Third IEEE International Conference on Intelligent Networking and Collaborative Systems, pp. 818-823. IEEE Computer Society.

Giuseppina Rita Mangione
Modelli Matematici e Applicazioni (MoMA, SpA)
Baronissi, Italy
mangione@momanet.it

Santi Caballé
Open University of Catalonia, eLearn Center
Barcelona, Spain
scaballe@uoc.edu

Regular Articles Section

Mobile Learning Adoption: Handover from Technology to Consumer

Introduction

The technology acceptance model (TAM) and the unified theory of acceptance and use of technology model (UTAUT) (Venkatesh, Morris, Davis, & Davis, 2003) have often been used to evaluate mobile learning adoption (See Table 1). TAM originates from the theory of reasoned action (TRA). Perceived ease of use and perceived usefulness are two key concepts that influence a user's attitude toward using the system and that attitude, together with perceived usefulness, determines use intention. TAM can be regarded as representing a utilitarian and usability perspective. Some opponents of TAM have argued that TAM is too general and lacks specificity and explanatory utility. Because TAM and UTAUT have been extensively researched, the question is whether they will continue to generate new knowledge especially in mobile learning adoption. To this end, it is recommended that researchers explore other theories to explain the adoption of mobile learning. This article introduces the consumer values theory which is rooted strongly in consumer behavior and marketing.

Consumer Values Model

Consumer purchasing decisions are dependent on the perceived values embedded within the product and service (Dodds & Monroe, 1985). Likewise, values embedded within mobile learning as perceived by learners /consumers can influence adoption decisions. A framework for consumer values has been developed by Sheth, Newman, & Gross (1991). Their model is widely supported in a variety of fields associated with value. The model categorizes consumption values into five types: *functional, conditional, social, emotional, and epistemic*. *Functional* value refers to the utilitarian or physical attributes of the product. Its influence on consumer choice is established in traditional economic utility theory. *Social* utilities are values that enable the individual to develop close associations with a community or group. Often, this takes the form of a reference group, a community which the individual wishes to join. *Emotional* values are associated with the affect feelings stimulated through the consumption of a product or service. Emotional values are not only embedded within the product but also the atmosphere surrounding the product, or the context in which the product is consumed. *Epistemic* value is associated with customer curiosity or the need to learn, and is often seen in the purchase of novelty products. Finally *conditional* values are those influenced by situational factors (Sheth, et al., 1991). Sheth's model has been applied in studies of consumption behavior in different technology settings (Tang & Forster, 2007; Andrews, Kiel, Drennan, Boyle, & Weerawardena, 2007; Cheng, Wang, Lin, & Vivek, 2009; Pura, 2005). Therefore the theory of consumption values can be quite robust and suitably deployed in technology adoption.

A proposed Mobile Learning Adoption Model

Based on the above review and the theory of consumer values, a proposed model to evaluate mobile learning adoption is depicted in Figure 1 and the hypotheses are listed below:

- H1: Functional values will positively influence user behavioral intentions to adopt mobile learning
- H2: Emotional values will positively influence user behavioral intentions to adopt mobile learning

H3: Epistemic values will positively influence user behavioral intentions to adopt mobile learning

H4: Conditional values will positively influence user behavioral intentions to adopt mobile learning

H5: Social values will positively influence user behavioral intentions to adopt mobile learning

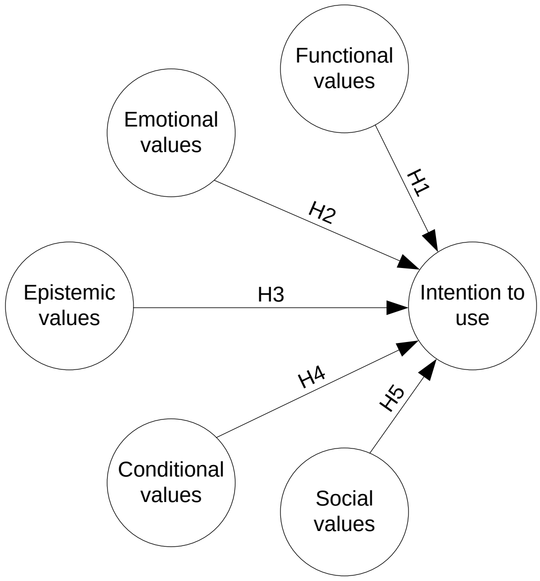


Figure 5 Consumer Values Model

Conclusion

In the field of education, learners are becoming more like consumers. Mobile learning adoption based on a consumer values perspective has the potential to uncover new findings not previously reported using traditional TAM and UTAUT. A quick literature review from 2005 to 2011 has shown that our understanding of mobile learning adoption remains limited. It is time that we handover from technology to other perspectives.

References

Akour, H. (2009). *Determinants of mobile learning acceptance: an empirical investigation in higher education*. Retrieved from http://dc.library.okstate.edu/u?/dissert1,86727

Andrews, L., Kiel, G., Drennan, J., Boyle, M. V., & Weerawardena, J. (2007). Gendered perceptions of experiential value in using web-based retail channels. *European Journal of Marketing, 41*(5/6), 640-658.

Chang, C.-K. (2010). Acceptability of an asynchronous learning forum on mobile devices. *Behaviour & Information Technology, 29*, 23-33.

Cheng, J. M. S., Wang, E. S. T., Lin, J. Y. C., & Vivek, S. D. (2009). Why do customers utilize the internet as a retailing platform?: A view from consumer perceived value. *Asia Pacific Journal of Marketing and Logistics, 21*(1), 144-160.

Dodds, W. B. & Monroe, K. B. (1985). The effect of brand and price information on subjective product evaluations. Advances in Consumer Research, 12(1), 85-90.

Donaldson, R. L. (2011). *Student acceptance of mobile learning*. Retrieved from http://etd.lib.fsu.edu/theses/available/etd-05312011-074842/unrestricted/Donaldson_R_dissertation_2011.pdf

Huang, J.-H., Lin, Y.-R., & Chuang, S.-T. (2007). Elucidating user behavior of mobile learning: A perspective of the extended technology acceptance model. *Electronic Library, 25*(5), 585-598.
Ismail, I., Idrus, R., & Johari, S. (2010). Acceptance on mobile learning via SMS: A Rasch Model Analysis. *International Journal of Interactive Mobile Technologies, 4*, 10-16.
Jairak, K., Praneetpolgrang, P., & Mekhabunchakij, M. (2009). *An acceptance of mobile learning for higher education students in Thailand*. Paper presented at The Sixth International Conference of eLearning for Knowledge-Based Society 17-18 December 2009, Thailand.
Liu, Y. (2008). *An adoption model for mobile learning*. Paper presented at the IADIS International Conference e-Commerce Amsterdam 2008.
Lowenthal, J. N. (2010). Using mobile learning: Determinates impacting behavioral intention. *American Journal of Distance Education 24*(4), 195-206
Park, S. Y., Nam, M.-W., & Cha, S.-B. (2011). University students' behavioral intention to use mobile learning: Evaluating the technology acceptance model. . *British Journal of Educational Technology, doi: 10.1111/j.1467-8535.2011.01229.x.*
Phuangthong, D., & Malisawan, D. (2005). A study of behavioral intention for 3G mobile internet technology: preliminary research on mobile learning. *Proceedings of the Second International Conference on eLearning for Knowledge-Based Society, August 4–7, 2005, Bangkok, Thailand.*
Pura, M. (2005). Linking perceived value and loyalty in location-based mobile services. *Managing Service Quality, 15*(6), 509-538.
Sheth, J. N., Newman, B. I., & Gross, B. L. (1991). Why we buy what we buy: a theory of consumption values. *Journal of Business Research, 22*(2), 159-170.
Tang, Y., & Forster, P. (2007). Exploring the value structure behind mobile auction adoption intention. *AMCIS 2007 Proceedings. paper 499.*
Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly, 27*(3), 425-478.
Wang, Y.-S., Wu, M.-C., & Wang, H.-Y. (2009). Investigating the determinants and age and gender differences in the acceptance of mobile learning. *British Journal of Educational Technology, 40*, 92-118 doi: 110.1111/j.1467-8535.2007.00809.x.
Williams, P. W. (2009). *Assessing mobile learning effectiveness and acceptance*. Retrieved from http://tiny.cc/b1qdn

Tiong-Thye Goh
Victoria University of Wellington
New Zealand
Tiong.goh@vuw.ac.nz

References	Theoretical Foundation	Construct/Factors	Context/Sample
(Phuangthong & Malisawan, 2005)	Technology acceptance model (TAM)	Perceived usefulness Perceived ease of use Enjoyment Attitude Behavioral intention	385 samples from Thailand
(Huang, Lin, & Chuang, 2007)	Technology acceptance model (TAM)	Perceived usefulness Perceived ease of use Perceived mobility value Perceived enjoyment Attitude, Behavioral intention	313 undergraduate and graduate students in two Taiwan universities
(Liu, 2008)	Unified Theory of Acceptance and Use of Technology (UTAUT)	Self-efficacy Mobility Attainment value Perceived enjoyment Self-management of learning, Performance expectancy Effort expectancy Social influence Facilitating conditions Behavioral intention Use behavior	Conceptual, no data reported
(Williams, 2009)	Unified Theory of Acceptance and Use of Technology (UTAUT)	Mode of delivery Performance expectancy Effort expectancy Social influence Facilitating conditions Behavioral intention Performance	107 undergraduate from Introduction to Information Systems course participated in the study
(Akour, 2009)	Technology acceptance model (TAM)	Ease of use Ease of access University commitment Student readiness Extrinsic influence Usefulness Quality of service Behavioral intention Attitude	255 freshman students from Oklahoma State University
(Jairak, Praneetpolgrang, & Mekhabunchakij, 2009)	Unified Theory of Acceptance and Use of Technology (UTAUT)	Performance expectancy Effort expectancy Social factors Facilitating conditions Attitude Behavioral intention	390 higher education students in Thailand
(Wang, Wu, & Wang, 2009)	Unified Theory of Acceptance and Use of Technology (UTAUT)	Performance expectancy Effort expectancy Self-management of learning social influence perceived playfulness Age Gender Behavioral intention	Respondents' perceived adoption of mobile learning (no actual usage) 330 participants from 5 different organizations in Taiwan
(Lowenthal, 2010)	Unified Theory of Acceptance and Use of Technology (UTAUT)	Performance expectancy Effort expectancy Self-management of learning Age Gender Behavioral intention	University students' adoption of mobile learning 113 university students from USA
(Chang, 2010)	Technology acceptance model (TAM)	Perceived usefulness Perceived ease of use	Acceptance of an asynchronous learning Sample size not reported
(Ismail, Idrus, & Johari, 2010)	Technology acceptance model (TAM)	Perceived usefulness Perceived ease of use Usability	105 students from management and sciences disciplines in Malaysia
(Park, Nam, & Cha, 2011)	Technology acceptance model (TAM)	Self-efficacy Major relevance System accessibility Subjective norm Perceived usefulness Perceived ease of use Attitude Behavioral intention	University students' adoption of mobile learning 288 university students from Korea
(Donaldson, 2011)	Unified Theory of Acceptance and Use of Technology (UTAUT)	Voluntariness of use Performance expectancy Effort expectancy Self-management of learning social influence perceived playfulness Facilitating conditions Behavioral intention	330 participants in community college in North Florida

Table 1 A review of mobile learning adoption model

Conference Announcements

Game-Based Learning for 21st Century Transferable Skills: Challenges and Opportunities

ICALT 2012 Rome features a workshop on game-based learning.

It is broadly acknowledged that digital games offer a high potential to foster and support learning. The term "serious game" refers to games which primary purpose is other than entertainment, and most serious games have a purpose for learning and training.

Most research studies analyze the relationship between games (characteristics/genres), learning objectives, and target groups from various perspectives. Such studies investigate, for instance, which games are suited best for applying the learning objectives while simultaneously considering the game context and target population.

This workshop will address, in particular, how digital games can contribute to contemporary knowledge society requirements towards the effective acquisition of more transferable skills (i.e. those abilities that support learning in task performance across multiple disciplines and subject areas, thus enhancing sustainable learning). Examples of transferable skills: collaboration, critical thinking, creative thinking, problem solving, reasoning abilities, learning to learn or decision making. This workshop will explore new opportunities offered by (digital) serious games in meeting these new demands.

Two complementary perspectives are considered in this workshop:

1. How can games foster formal and informal learning and
2. How can their design, development and deployment contributes towards this learning purpose.

The first perspective refers to the fact that learning processes cannot be understood by merely looking at the specific characteristics of the ICT-based tools used to promote learning, but that one also needs to consider the complete context in which games are deployed (including goals, tools, tasks, and culture). Educational researchers become increasingly aware of this integrated perspective. In fact, it is needed to address the interplay between the game technology and the educational practice: that is, the activities that can be accomplished thanks to technology mediation for achieving the agreed learning goals.

The second perspective refers to the methods, techniques and tools that are applied in the design and the development of pedagogically sound games. In particular, this perspective aims to focus on the development and application of methods and tools that can support effective user assessment in game based learning. Breakthroughs in this area can be made by advancing the effectiveness and efficiency of issues including, but not limited to:

- User feedback mechanisms.
- User data gathering and management.
- Sensor data fusion and integration.
- Data analysis methods.
- Easy-to-use user interfaces.

We regard the interplay of these two perspectives (i.e., the use and design of games for education) crucial for the future of game based learning and this workshop therefore intends to stimulate a fruitful dialogue between them.

Authors are invited to submit original research work that contributes to new developments in the area of game based learning for 21st century transferable skills including devices, hardware/software tools, design and development methodologies, educational applications, evaluation and assessment studies or case studies of exemplary use.

Important Dates

Deadline: proposals deadlines will be in accordance with the ICALT deadlines.

- **Deadline for workshopcontributions**: February 15, 2012
- **Notification of acceptance of Workshops' papers**: March 5, 2012
- **Authors' Registration Deadline**: March 15, 2012
- **Camera-Ready paper (up to 2 pages)**: April 1, 2012

How to submit papers

In order to submit a paper to the workshop you should send your contribution by email to Francesco Belloti (**sg.icalt@gmail.com**) with copy (CC) to **icalt2012@e-ucm.es.** We will confirm you if your paper has been received correctly.

More information

http://seriousgames-icalt2012.e-ucm.es/

User Assessment in Serious Games and Technology-Enhanced Learning

Advances in Human Computer Interaction Special Issue

Call for Papers

Serious games (SG) and technology enhanced learning (TEL) tools are becoming ever more important for education and training. However, their effective application demands appropriate metrics, tools, and techniques for measuring elements such as learning outcomes, engagement or gameplay performance. Devices like stereo cameras, eye trackers, galvanic skin response sensors, and neural impulse actuators (amongst others), now available at reasonable prices, not only support innovative interactions, but they also present opportunities to new user monitoring and evaluation.

Due to the complexity of human nature and individual differences, objective and systematic assessment of human behavior and performance remains highly difficult. In addition, data analysis and evaluation methods for technology-assisted learning and assessment are still under-developed because of different perspectives in evaluation. Development of systems and tools able to support provision of effective feedback is a major requirement for a new generation of SGs and TEL tools. Breakthroughs in this area can be made by advancing issues including, but not limited to: a) an efficient and easy-to-use user interface, b) effective data management, c) sensor data fusion and integration, d) data analyses methods, and e) user feedback mechanism.

Authors are invited to submit original research articles as well as review articles that describe new devices, hardware/software tools, methodologies, systems, applications and evaluation studies about user assessment in SGs and TEL – with a special perspective on usability and usefulness for learning. Potential topics include, but are not limited to:

- Automatic/interactive assessment of user performance
- In-game assessment mechanics
- Time and precision effects
- Metrics for measuring fun and/or learning outcomes
- User satisfaction and fun evaluation
- User modeling and profiling
- User adaptivity and personalization
- Score rules and mechanisms
- Automated recommendation mechanisms
- Feedback to the users
- Advanced user interaction
- Advanced user sensors and transducer systems for assessment
- Sensor data fusion

Before submission, authors should carefully read over the journal's Author Guidelines, which are located at http://www.hindawi.com/journals/ahci/guidelines/. Every article requires a 600$ processing charge. Prospective authors should submit an electronic copy of their complete manuscript through the journal Manuscript Tracking System at http://mts.hindawi.com/ according to the following timetable:

Manuscript Due	April 13, 2012
First Round of Reviews	July 6, 2012
Publication Date	August 31, 2012

Lead Guest Editor

- **Francesco Bellotti**, Department of Electronics and Biophysical Engineering, University of Genoa, Italy; franz@elios.unige.it

Guest Editors

- **Bill Kapralos**, Faculty of Business and Information Technology, University of Ontario Institute of Technology, Oshawa, Canada; bill.kapralos@uoit.ca
- **Kiju Lee**, Department of Mechanical and Aerospace Engineering, Case Western Reserve University, Cleveland, OH, USA; kiju.lee@case.edu
- **Pablo Moreno-Ger**, Faculty of Computer Science, Universidad Complutense de Madrid, Spain; pablom@fdi.ucm.es

ICT in Education

8th Pan-Hellenic Conference with International Participation

28-30 September 2012, University of Thessaly, Volos, Greece

http://hcicte2012.uth.gr

The 8th Pan-Hellenic Conference with International Participation "ICT in Education" (HCICTE 2012) is the biannual scientific conference of the Hellenic Association of ICT in Education (HAICTE), aiming to address the main issues of concern within ICT in Education and e-Learning.

HCICTE 2012 covers technological, pedagogical, organizational, instructional as well as policy aspects of ICT in Education and e-Learning. Special emphasis is given to applied research relevant to educational practice guided by the educational realities in schools, colleges, universities and informal learning organizations.

HCICTE 2012 aims to serve as a forum for academicians and researchers from around the world to present their current work. The Conference especially welcomes articles coming from the Greek Diaspora, as well as the Mediterranean countries.

The main topics of interest include, but are not limited to:

- ICT-based Learning
- Computer Supported Collaborative Learning
- Learning, eLearning and Pedagogy
- Learning Technologies
- ICT and Instructional Design
- E-Content - Development and Delivery
- 21st century Education - Educational policy and ICT
- Education for sustainable development, Sustainable School and ICT
- ICT and Teachers' Professional Development
- Sociology of Education and ICT
- ICT-enhanced Science Education
- ICT-enhanced Language Learning
- Educational Gaming
- Virtual Learning Environments
- Web 2.0 applications in Education
- Social Networks for Learning and Knowledge Sharing
- Wireless, Mobile and Ubiquitous Technologies for Learning
- E-learning in Higher and Tertiary Education
- E-learning and lifelong Learning
- ICT and lifelong Learning
- Distance Learning – Models, Systems and Architectures
- Digital Literacy and Digital Competence
- E-Assessment - Theories and Methodologies

Authors are invited to submit original papers on research results or novel applications of ICT in education and e-learning. The Conference will be composed of several types of contributions:

- *Keynote Talks*: These will be invited contributions from well-known scholars and scientists in the field. An abstract will be included in the conference proceedings.
- *Full Papers*: These include mainly accomplished original research results and may have 8 pages at maximum.

- *Short Papers*: These are mostly composed of work in progress reports, fresh developments, individual projects or on-going work of PhD students. They have 4 pages at maximum.
- *Workshops*: A Workshop is a collection of papers on a theme that has been coordinated and led by the workshop's leader(s). The aim the workshops is to bring together various research and development groups, to serve as a forum for establishing new collaborations, to attract both research results and work in progress, and to define main enablers and future challenges. The workshop leader should provide an abstract briefly describing the theme and its significance for the field of ICT in education, and a submission file with around 200 word abstracts of each paper. The workshop contribution papers may publish as full papers and have 8 pages at the maximum.
- *Panels*: Discussions on selected topics will be held. A proposal of maximum 250 words is expected.

Important Dates

- Submission deadline: March 1, 2012
- Author's Notification: May 31, 2012
- Final Camera-Ready Submission: July 15, 2012
- Author's Registration: Until July 15, 2012
- Early Registration: Until August 15, 2012
- Late Registration: After August 15, 2012
- Conference: September 28-30, 2012 Volos, Greece

Contact

- Charalampos Karagiannidis (karagian@uth.gr)
- Panagiotis Politis (ppopl@uth.gr)
- Ilias Karasavvidis (ikaras@uth.gr)