Lecture Notes in Computer Science 7315

Commenced Publication in 1973
Founding and Former Series Editors:
Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

Editorial Board

David Hutchison
Lancaster University, UK

Takeo Kanade
Carnegie Mellon University, Pittsburgh, PA, USA

Josef Kittler
University of Surrey, Guildford, UK

Jon M. Kleinberg
Cornell University, Ithaca, NY, USA

Alfred Kobsa
University of California, Irvine, CA, USA

Friedemann Mattern
ETH Zurich, Switzerland

John C. Mitchell
Stanford University, CA, USA

Moni Naor
Weizmann Institute of Science, Rehovot, Israel

Oscar Nierstrasz
University of Bern, Switzerland

C. Pandu Rangan
Indian Institute of Technology, Madras, India

Bernhard Steffen
TU Dortmund University, Germany

Madhu Sudan
Microsoft Research, Cambridge, MA, USA

Demetri Terzopoulos
University of California, Los Angeles, CA, USA

Doug Tygar
University of California, Berkeley, CA, USA

Gerhard Weikum
Max Planck Institute for Informatics, Saarbruecken, Germany

Stefano A. Cerri William J. Clancey
Giorgos Papadourakis Kitty Panourgia (Eds.)

Intelligent Tutoring Systems

11th International Conference, ITS 2012
Chania, Crete, Greece, June 14-18, 2012
Proceedings

Springer

Volume Editors

Stefano A. Cerri
LIRMM: University of Montpellier and CNRS
161 rue Ada, 34095 Montpellier, France
E-mail: cerri@lirmm.fr

William J. Clancey
NASA and Florida Institute for Human and Machine Cognition
Human Centered Computing - Intelligent Systems Division
Moffett Field, CA 94035, USA
E-mail: william.j.clancey@nasa.gov

Giorgos Papadourakis
Technological Educational Institute of Crete
School of Applied Technology
Department of Applied Informatics and Multimedia
Stavromenos, P.O. Box 1939
71004 Heraklion, Crete, Greece
E-mail: papadour@cs.teicrete.gr

Kitty Panourgia
Neoanalysis Ltd.
Marni 56, 10437 Athens, Greece
E-mail: kpanourgia@neoanalysis.eu

ISSN 0302-9743 e-ISSN 1611-3349
ISBN 978-3-642-30949-6 e-ISBN 978-3-642-30950-2
DOI 10.1007/978-3-642-30950-2
Springer Heidelberg Dordrecht London New York

Library of Congress Control Number: 2012939156

CR Subject Classification (1998): I.2.6, J.4, H.1.2, H.5.1, J.5, K.4.2

LNCS Sublibrary: SL 2 – Programming and Software Engineering

© Springer-Verlag Berlin Heidelberg 2012
This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer. Violations are liable to prosecution under the German Copyright Law.
The use of general descriptive names, registered names, trademarks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India

Printed on acid-free paper

Springer is part of Springer Science+Business Media (www.springer.com)

Preface

The 11th International Conference on Intelligent Tutoring Systems, ITS 2012, was organized in Chania, Crete, Greece, during June 14–18, 2012. The Call for Papers is printed here to relate the conference's motivation and theme:

> *The Intelligent Tutoring Systems (ITS) 2012 conference is part of an on-going biannual series of top-flight international conferences (the ITS conference was launched in 1988) on technologies—systems—that enable, support or enhance human learning. This occurs by means of tutoring—in the case of formal learning—and by exposing learners to rich interactive experiences—in the case of learning as a side effect (informal learning). The "intelligence" of these systems stems from the model-based artificial intelligence technologies often exploited to adapt to the learners (e.g., semantic technologies, user modeling) and also from how today's technologies (e.g., the Web and service-oriented computing methods) facilitate new emergent collective behaviors. These new practices may outperform previously conceivable learning or tutoring scenarios because they modify significantly the power, speed, and focus of participants' interactions independently from space and time constraints. The highly interdisciplinary ITS conferences bring together researchers in computer science, informatics, and artificial intelligence on the one side (the "hard" sciences); cognitive science, educational psychology, and linguistics on the other (the "soft" sciences).*
>
> *The specific theme of the ITS 2012 conference is co-adaptation between technologies and human learning. There are nowadays two real challenges to be faced by ITS. The main technical challenge is due to the unprecedented speed of innovation that we notice in Information and Communication Technologies (ICT), in particular, the Web. Any technology seems to be volatile, of interest for only a short time span. The educational challenge is a consequence of the technical one. Current educational uses of technologies have to consider the impact of ICT innovation on human practices. In particular, new technologies may modify substantially the classical human learning cycle, which since the nineteenth century was mainly centered on formal teaching institutions such as the schools. Educational games are an example of how instructional practice adapts to innovation; another is the measurable role of emotions in learning.*
>
> *Therefore, our focus for ITS 2012 will be not just on the use of technologies but also the co-adaptation effects. Rapidly evolving technologies entail significant new opportunities and scenarios for learning, thus support the need for analyzing the intersection between new learning practices and innovative technologies to advance both methods and theory for*

> *human learning. This approach especially enables "learning by constructing," in much the same way as the Web Science movement adds to the classical Web technologies. A new design priority has emerged: reasoned analysis of human communities in different interaction contexts before deploying or applying a new infrastructure or application.*
>
> *On the one hand this scientific analysis will guide us to avoid well-known pitfalls, on the other it will teach us lessons not only about how to exploit the potential learning effects of current advanced technologies—the applicative approach—but also how to envision, elicit, estimate, evaluate the potential promising effects of new technologies and settings to be conceptualized, specified and developed within human learning scenarios—the experimental approach. We expect this experimental approach to produce long-term scientific progress both in the hard and in the soft sciences, consolidating at the same time important socio-economic benefits from the new infrastructures and the new applications for human learning.*

As a result of the Call for Papers, we received more than 200 different contributions evaluated by chairs of four different tracks: the Scientific Paper Track (Chairs: Stefano A. Cerri and William J. Clancey), the Young Researcher Track (Chairs: Roger Azevedo and Chad Lane), the Workshop and Tutorial Track (Chairs: Jean Marc Labat and Rose Luckin). One Panel: "The Next Generation: Pedagogical and Technological Innovations for 2030" were organized by the Panel Chairs: Beverly Woolf and Toshio Okamoto.

For the scientific paper track, we provide a summary of the statistics at the end of the preface. In addition, 14 out of 15 Young Researcher Track papers were accepted, five workshops and two tutorials. There have been four outstanding invited speakers whose contributions have been included in the electronic version of the proceedings.

The scientific papers were evaluated with the help of a popular conference management tool, EasyChair, which was an excellent example of co-adaptation: we were impressed by the space of potential variations in the business process definition and management that is available thanks to the online tool. We believe that the "configuration" choices may have a significant impact on the positive quality of the resulting program.

We chose to assign three "junior" reviewers and one "senior" reviewer to each paper in order to delegate as much as possible to a team of four reviewers the difficult selection task. With the help of EasyChair, we carefully checked the fit of the paper's topics with the reviewer's selected topics of expertise and avoided conflict of interests due to proximity, historical, or professional relations.

The process was triple blind: reviewers did not know the authors' names, authors did not know the reviewers' names, and reviewers did not know the other reviewers' names. We guided the evaluation process by means of an evaluation form suggesting to accept about 15% of long papers, 15–30% of short papers and 30% of posters. The reviewer's evaluations naturally respected our suggestions: out of 177 papers, we accepted 134, consisting of 28 long (16%), 50 short

(28%) and 56 posters (32%). In our view, the quality of long papers is excellent, short papers are good papers, and posters present promising work that deserves attention and discussion.

The decision taken by the senior reviewer was respected in almost all cases, with a very limited number of exceptions that always involved raising the rank of the paper. Our conviction is that the reviewers were very critical, but also extremely constructive, which was confirmed by most of the exchanges with the authors after notification of the decision. The authors of the rejected papers also benefited from a careful review process, with feedback that we hope will help them to improve the quality of the presentations.

We can state without any doubt that ITS 2012 was a very selective, high-quality conference, probably the most selective in the domain.

On the one hand, we wished to guarantee a high acceptance rate and therefore participation at the conference. On the other, we wished to reduce the number of parallel tracks and enable papers accepted as short or long to be attended by most of the participants in order to enhance the historical interdisciplinary nature of the conference and the opportunity for a mutual learning experience. We also wished to increase the number of printed pages in the proceedings for each paper. The result has been to allow ten pages for long papers, six for short ones, and two for posters. The Young Researcher Track's 14 papers are also included in the proceedings (three pages).

The classification by topic in the book reflects viewpoints that are necessarily subjective. What appears as a major phenomenon is that the domain of ITS is becoming increasingly intertwined: theory and experiments, analysis and synthesis, planning and diagnosis, representation and understanding, production and consumption, models and applications. It has not been easy to sort the papers according to topics. In the sequencing of papers in the book, we have tried as much as possible to reflect the sequence of papers in the conference sessions.

We thank first of all the authors, then the members of the Program Committee and the external reviewers, the Steering Committee and in particular Claude Frasson and Beverly Woolf, both present, supportive and positive all the time, the local Organizing Committee, finally each and all the other organizers that are listed on the following pages. Such an event would not have been possible without their commitment, professional effort and patience.

April 2012

Stefano A. Cerri
William J. Clancey
Giorgios Papadourakis
Kitty Panourgia

STATISTICS

By Topic

Topic	Submissions	Accepted	Acceptance Rate	PC Members
Evaluation, privacy, security and trust in e-learning processes	4	2	0.50	5
Ubiquitous and mobile learning environments	5	4	0.80	33
Ontological modeling, Semantic web technologies and standards for learning	7	4	0.57	30
Non-conventional interactions between artificial intelligence and human learning	8	6	0.75	25
Recommender systems for learning	9	4	0.44	31
Informal learning environments, learning as a side effect of interactions	12	10	0.83	32
Multi-agent and service-oriented architectures for learning and tutoring environments	12	8	0.67	22
Instructional design principles or design patterns for educational environments	21	14	0.67	23
Authoring tools and development methodologies for advanced learning technologies	21	12	0.57	34
Discourse during learning interactions	22	20	0.91	17
Co-adaptation between technologies and human learning	22	13	0.59	26
Virtual pedagogical agents or learning companions	23	17	0.74	37
Collaborative and group learning, communities of practice and social networks	23	18	0.78	49
Simulation-based learning, intelligent (serious) games	33	29	0.88	48
Modeling of motivation, metacognition, and affect aspects of learning	33	23	0.70	38
Empirical studies of learning with technologies, understanding human learning on the Web	35	27	0.77	42

Topic	Submissions	Accepted	Acceptance Rate	PC Members
Domain-specific learning domains, e.g., language, mathematics, reading, science, medicine, military, and industry	36	27	0.75	23
Educational exploitation of data mining and machine learning techniques	38	30	0.79	30
Adaptive support for learning, models of learners, diagnosis and feedback	61	44	0.72	64
Intelligent tutoring	79	62	0.78	66

By Country

Country	Authors	Submitted papers
Algeria	2	1.00
Australia	10	4.00
Austria	-	-
Brazil	21	8.02
Canada	40	17.54
Costa Rica	1	0.11
Czech Republic	2	1.00
Denmark	1	1.50
Egypt	1	0.33
Finland	1	1.00
France	31	11.53
Germany	12	3.87
Greece	13	4.83
Hong Kong	2	0.20
India	7	4.33
Ireland	-	-
Italy	-	-
Japan	24	9.75

Country	Authors	Submitted papers
Korea, Republic of	-	-
Latvia	1	0.33
Mexico	2	0.67
The Netherlands	9	3.00
New Zealand	8	4.17
Philippines	6	1.06
Portugal	4	1.00
Romania	4	2.67
Saudi Arabia	2	1.33
Singapore	-	-
Slovakia	-	-
Slovenia	6	1.33
Spain	23	6.25
Switzerland	5	0.71
Taiwan	8	2.00
Tunisia	2	1.33
United Kingdom	15	7.08
United States	178	75.04

Committees

Conference Committee

Conference Chair

George M. Papadourakis	Technological Educational Institute of Crete, Greece

General Chair

Maria Grigoriadou	University of Athens, Greece

Program Chairs

Stefano A. Cerri (Chair)	LIRMM: University of Montpellier and CNRS, France
William J. Clancey (Co-chair)	NASA and Florida Institute for Human and Machine Cognition, USA

Organization Chair

Kitty Panourgia	Neoanalysis, Greece

Workshops and Tutorials Chairs

Jean Marc Labat	Pierre and Marie Curie University, France
Rose Luckin	Institute of Education, UK

Panels Chairs

Beverly Woolf	University of Massachussetts, USA
Toshio Okamoto	University of Electro-Communications, Japan

Young Researcher Track Chairs

Roger Azevedo	McGill University, Canada
Chad Lane	University of Southern California, USA

Program Committee

Program Chairs

Stefano A. Cerri (Chair)	LIRMM: University of Montpellier and CNRS, France
William J. Clancey (Co-chair)	NASA and Florida Institute for Human and Machine Cognition, USA

Senior Program Committee

Esma Aimeur	University of Montreal, Canada
Vincent Aleven	Carnegie Mellon University, USA
Ivon Arroyo	University of Massachusetts, USA
Kevin Ashley	University of Pittsburgh, USA
Ryan Baker	Worcester Polytechnic Institute, USA
Joseph Beck	Worcester Polytechnic Institute, USA
Gautam Biswas	Vanderbilt University, USA
Jacqueline Bourdeau	Tele-université, Montreal, Quebec, Canada
Bert Bredeweg	University of Amsterdam, The Netherlands
Paul Brna	University of Edinburgh, UK
Peter Brusilovsky	University of Pittsburgh, USA
Chan Tak-Wai	National Central University, Taiwan
Cristina Conati	University of British Columbia, Canada
Ricardo Conejo	University of Malaga, Spain
Albert Corbett	Carnegie Mellon University, USA
Elisabeth Delozanne	University Pierre et Marie Curie, France
Vania Dimitrova	University of Leeds, UK
Benedict Du Boulay	University of Sussex, UK
Isabel Fernandez-Castro	University of Basque Country, Spain
Claude Frasson	University of Montreal, Canada
Guy Gouarderes	University of Pau, France
Art Graesser	University of Memphis, USA
Peter Hastings	DePaul University, USA
Neil Heffernan	Worcester Polytechnic Institute, USA
W. Lewis Johnson	Alelo Inc., USA
Kenneth Koedinger	Carnegie Mellon University, USA
Jean-Marc Labat	Universite Pierre et Marie Curie, France
Susanne Lajoie	McGill University, Canada
H. Chad Lane	University of Southern California, USA
James Lester	North Carolina State University, USA
Diane Litman	University of Pittsburgh, USA
Chee-Kit Looi	National Institute of Education, Singapore
Rosemary Luckin	University of Sussex, UK

Gordon Mccalla	University of Saskatchewan, Canada
Tanja Mitrovic	University of Canterbury, New Zealand
Riichiro Mizoguchi	Osaka University, Japan
Jack Mostow	Carnegie Mellon University, USA
Roger Nkambou	University of Quebec at Montreal, Canada
Stellan Ohlsson	University of Illinois at Chicago, USA
Toshio Okamoto	University of Electro-Communications, Japan
Ana Paiva	INESC-ID and Instituto Superior Tecnico, Technical University of Lisbon, Portugal
Niels Pinkwart	Clausthal University of Technology, Germany
Carolyn Rose	Carnegie Mellon University, USA
Kurt Van Lehn	Arizona State University, USA
Julita Vassileva	University of Saskatchewan, Canada
Rosa Vicari	The Federal University of Rio Grande do Sul, Brazil
Maria Virvou	University of Piraeus, Greece
Vincent Wade	Trinity College Dublin, Ireland
Gerhard Weber	University of Education Freiburg, Germany
Beverly Woolf	University of Massachusetts, USA
Kalina Yacef	University of Sydney, Australia

Program Committee

Mohammed Abdelrazek	King Abdulaziz University, Saudi Arabia
Luigia Aiello	University of Rome, Italy
Colin Alison	St.Andrews University, UK
Ana Arruarte	University of the Basque Country, Spain
Roger Azevedo	McGill University, Canada
Tiffany Barnes	University of North Carolina at Charlotte, USA
Beatriz Barros	University of Malaga, Spain
Maria Bielikova	Slovak University of Technology in Bratislava, Slovakia
Ig Bittencourt	Federal University of Alagoas, Brazil
Emmanuel G. Blanchard	Aalborg University at Copenhagen, Denmark
Steve Blessing	University of Tampa, USA
Joost Breuker	University of Amsterdam, The Netherlands
Nicola Capuano	University of Salerno, Italy
Patricia Charlton	London Knowledge Lab, UK
Zhi-Hong Chen	National Central University, Taiwan
Chih-Yueh Chou	Yuan Ze University, Taiwan
Evandro Costa	Federal University of Alagoas, Brazil
Scotty Craig	University of Memphis, USA
Alexandra Cristea	University of Warwick, UK

Sydney D'Mello	University of Memphis, USA
Hugh Davis	University of Southampton, UK
Michel Desmarais	Polytechnique Montreal, Canada
Cyrille Desmoulins	University of Grenoble, France
Darina Dicheva	Winston-Salem State University, USA
Pierre Dillenbourg	Ecole Polytechnique Federale de Lausanne, Switzerland
Peter Dolog	Aalborg University, Denmark
Pascal Dugenie	IRD: Institut de Recherche pour le Développement, France
Robert Farrell	IBM Research, USA
Vasco Furtado	University of Fortaleza, Brazil
Franca Garzotto	Politecnico di Milano, Italy
Abdelkader Gouaich	LIRMM: University of Montpellier and CNRS, France
Yusuke Hayashi	Osaka University, Japan
Tsukasa Hirashima	Hiroshima University, Japan
Seiji Isotani	University Sao Paulo, Brazil
Patricia Jaques	Universidade do Vale do Rio dos Sinos (UNISINOS), Brazil
Clement Jonquet	University of Montpellier - LIRMM, France
Pamela Jordan	University of Pittsburgh, USA
Vana Kamtsiou	Brunel University, London, UK
Akihiro Kashihara	University of Electro-Communications, Japan
Kathy Kikis-Papadakis	FORTH, Crete, Greece
Yong Se Kim	Sungkyunkwan University, Republic of Corea
Philippe Lemoisson	CIRAD - TETIS, Montpellier, France
Stefanie Lindstaedt	Graz University of Technology and Know-Center, Austria
Chao-Lin Liu	National Chengchi University, Taiwan
Vincenzo Loia	University of Salerno, Italy
Manolis Mavrikis	London Knowledge Laboratory, UK
Riccardo Mazza	University of Lugano/University of Applied Sciences of Southern Switzerland, Switzerland
Germana Menezes Da Nobrega	Universidade de Brasilia (UnB), Brazil
Alessandro Micarelli	University of Roma, Italy
Kazuhisa Miwa	Nagoya University, Japan
Paul Mulholland	Knowledge Media Institute, The Open University, UK
Chas Murray	Carnegie Learning, Inc., USA
Wolfgang Nejdl	L3S and University of Hannover, Germany
Jean-Pierre Pecuchet	INSA Rouen, France
Alexandra Poulovassilis	University of London, UK

Andrew Ravenscroft	University of East London, UK
Genaro Rebolledo-Mendez	University of Veracruz, Mexico
Ma. Mercedes T. Rodrigo	Ateneo de Manila University, Philippines
Ido Roll	University of British Columbia, Canada
Paulo Salles	University of Brasilia, Brazil
Jacobijn Sandberg	University of Amsterdam, The Netherlands
Sudeshna Sarkar	Indian Institute of Technology Kharagpur, India
Hassina Seridi	Badji Mokhtar Annaba University, Algeria
Mike Sharples	The Open University, UK
Peter B. Sloep	The Open University, The Netherlands
John Stamper	Carnegie Mellon University, USA
Akira Takeuchi	Kyushu Institute of Technology, Japan
Josie Taylor	Institute of Educational Technology, Open University, UK
Thanassis Tiropanis	University of Southampton, UK
Stefan Trausan Matu	Bucarest Polytechnic, Romania
Andre Tricot	University of Toulouse, France
Wouter Van Joolingen	University of Twente, The Netherlands
Su White	University of Southampton, UK
Diego Zapata-Rivera	Educational Testing Service, USA
Ramon Zatarain-Cabada	Technological Institute of Culiacan, Mexico

Organization Committee

Chair

Kitty Panourgia	Neoanalysis, Greece

Members

Dimosthenis Akoumianakis	TEI of Crete, Greece
Yannis Kaliakatsos	TEI of Crete, Greece
Emmanuel S. Karapidakis	TEI of Crete, Greece
Athanasios Malamos	TEI of Crete, Greece
Harris Papoutsakis	TEI of Crete, Greece
Konstantinos Petridis	TEI of Crete, Greece
George Triantafilides	TEI of Crete, Greece

Treasurer: Neoanalysis

Student Volunteers Chairs

Pierre Chalfoun	University of Montreal, Canada

Mediterranean Committee

Chair

Mohammed Abdelrazek	King Abdulaziz University, Saudi Arabia

Members

Amar Balla	ENSI, Algeria
Stephane Bernard Bazan	Université Saint Joseph de Beyrouth, Lebanon
Isabel Fernandez-Castro	University of Basque Country, Spain
Khaled Guedira	Institut Supérieur de gestion, Tunisia
Gianna Martinengo	Didael KTS, Milan, Italy
Kyparisia Papanikolaou	School of Pedagogical & Technological Education, Greece

Steering Committee

Chair

Claude Frasson	University of Montreal, Canada

Members

Stefano Cerri	University of Montpellier, France
Isabel Fernandez-Castro	University of the Basque Country, Spain
Gilles Gauthier	University of Quebec at Montreal, Canada
Guy Gouardères	University of Pau, France
Mitsuru Ikeda	Japan Advanced Institute of Science and Technology, Japan
Marc Kaltenbach	Bishop's University, Canada
Judith Kay	University of Sidney, Australia
Alan Lesgold	University of Pittsburgh, USA
James Lester	North Carolina State University, USA
Roger Nkambou	University of Quebec at Montreal, Canada
Fabio Paragua	Federal University of Alagoas, Brazil
Elliot Soloway	University of Michigan, USA
Daniel Suthers	University of Hawai, USA
Beverly Woolf	University of Massachussets, USA

External Reviewers

Adewoyin, Bunmi
Alrifai, Mohammad
Bourreau, Eric
Campbell, Antoine
Chauncey, Amber
Cheney, Kyle
Chiru, Costin
Cialdea, Marta
Delestre, Nicolas
Doran, Katelyn

Elorriaga, Jon A.
Falakmasir, Mohammad Hassan
Floryan, Mark
Foss, Jonathan
Gkotsis, George
Gonzalez-Brenes, Jose
Grieco, Claudia
Gross, Sebastian
Guarino, Giuseppe
Gutierrez Santos, Sergio
Guzmán, Eduardo
Hayashi, Yugo
Henze, Nicola
Herder, Eelco
Hicks, Drew
Johnson, Matthew
Kojima, Kazuaki
Koriche, Fred
Labaj, Martin
Larrañaga, Mikel
Le, Nguyen-Thinh
Lehman, Blair
Lehmann, Lorrie
Limongelli, Carla
Lomas, Derek
Mangione, Giuseppina
Martin, Maite
Mazzola, Luca
Miranda, Sergio
Morita, Junya
Nickel, Andrea
Orciuoli, Francesco
Pardos, Zach
Pardos, Zachary
Peckham, Terry
Pierri, Anna
Pinheiro, Vladia
Rebedea, Traian
Ruiz, Samara
Sciarrone, Filippo
Scotton, Joshua
Sharipova, Mayya
Shaw, Erin
Steiner, Christina M.
Stepanyan, Karen
Sullins, Jeremiah
Thomas, John
Thomas, Keith
Trausan-Matu, Stefan
Tvarozek, Jozef
Urretavizcaya, Maite
van Lehn, Kurt
Vasconcelos, José Eurico
Wu, Kewen
Yudelson, Michael
Zipitria, Iraide
Šimko, Marián

Workshops

Intelligent Support for Exploratory Environments: Exploring, Collaborating, and Learning Together
Toby Dragon, Sergio Gutierrez Santos, Manolis Mavrikis, and Bruce M. Mclaren

Workshop on Self-Regulated Learning in Educational Technologies (SRL@ET): Supporting, Modelling, Evaluating, and Fostering Metacognition with Computer-Based Learning Environments
Amali Weerasinghe, Roger Azevedo, Ido Roll, and Ben Du Boulay

Intelligent Support for Learning in Groups
Jihie Kim and Rohit Kumar

Emotion in Games for Learning
Kostas Karpouzis, Georgios N. Yannakakis, Ana Paiva, and Eva Hudlicka

Web 2.0 Tools, Methodology, and Services for Enhancing Intelligent Tutoring Systems
Mohammed Abdel Razek and Claude Frasson

Tutorials

Important Relationships in Data: Magnitude and Causality as Flags for What to Focus on
Joseph Beck (WPI)

Parameter Fitting for Learner Models
Tristan Nixon (Carnegie Learning Inc.), Ryan S.J.D. Baker (WPI), Michael Yudelson (CMU), and Zach Pardos (WPI)

Scientific Sponsors

The following scientific associations have granted their scientific support to the conference; their members benefit from a special registration rate.

The conference benefits also from the sponsoring of the following renowned conferences:

- IJCAI : International Joint Conference in Artificial Intelligence
- ECAI : European Conference in Artificial Intelligence
- EDM : Educational Data Mining

Table of Contents

Affect: Emotions

Implicit Strategies for Intelligent Tutoring Systems 1
Imène Jraidi, Pierre Chalfoun, and Claude Frasson

Rudeness and Rapport: Insults and Learning Gains in Peer Tutoring . . . 11
Amy Ogan, Samantha Finkelstein, Erin Walker, Ryan Carlson, and Justine Cassell

On Pedagogical Effects of Learner-Support Agents in Collaborative Interaction 22
Yugo Hayashi

Exploration of Affect Detection Using Semantic Cues in Virtual Improvisation 33
Li Zhang

Measuring Learners Co-Occurring Emotional Responses during Their Interaction with a Pedagogical Agent in MetaTutor 40
Jason M. Harley, François Bouchet, and Roger Azevedo

Visualization of Student Activity Patterns within Intelligent Tutoring Systems 46
David Hilton Shanabrook, Ivon Arroyo, Beverly Park Woolf, and Winslow Burleson

Toward a Machine Learning Framework for Understanding Affective Tutorial Interaction 52
Joseph F. Grafsgaard, Kristy Elizabeth Boyer, and James C. Lester

Exploring Relationships between Learners' Affective States, Metacognitive Processes, and Learning Outcomes 59
Amber Chauncey Strain, Roger Azevedo, and Sidney D'Mello

Mental Workload, Engagement and Emotions: An Exploratory Study for Intelligent Tutoring Systems 65
Maher Chaouachi and Claude Frasson

Affect: Signals

Real-Time Monitoring of ECG and GSR Signals during Computer-Based Training 72
Keith W. Brawner and Benjamin S. Goldberg

Categorical vs. Dimensional Representations in Multimodal Affect Detection during Learning 78
Md. Sazzad Hussain, Hamed Monkaresi, and Rafael A. Calvo

Cognitive Priming: Assessing the Use of Non-conscious Perception to Enhance Learner's Reasoning Ability 84
Pierre Chalfoun and Claude Frasson

Games: Motivation and Design

Math Learning Environment with Game-Like Elements: An Incremental Approach for Enhancing Student Engagement and Learning Effectiveness 90
Dovan Rai and Joseph E. Beck

Motivational Factors for Learning by Teaching: The Effect of a Competitive Game Show in a Virtual Peer-Learning Environment 101
Noboru Matsuda, Evelyn Yarzebinski, Victoria Keiser, Rohan Raizada, Gabriel Stylianides, and Kenneth R. Koedinger

An Analysis of Attention to Student-Adaptive Hints in an Educational Game 112
Mary Muir and Cristina Conati

Serious Game and Students' Learning Motivation: Effect of Context Using Prog&Play 123
Mathieu Muratet, Elisabeth Delozanne, Patrice Torguet, and Fabienne Viallet

Exploring the Effects of Prior Video-Game Experience on Learner's Motivation during Interactions with HeapMotiv 129
Lotfi Derbali and Claude Frasson

A Design Pattern Library for Mutual Understanding and Cooperation in Serious Game Design 135
Bertrand Marne, John Wisdom, Benjamin Huynh-Kim-Bang, and Jean-Marc Labat

Games: Empirical Studies

Predicting Student Self-regulation Strategies in Game-Based Learning Environments 141
Jennifer Sabourin, Lucy R. Shores, Bradford W. Mott, and James C. Lester

Toward Automatic Verification of Multiagent Systems for Training Simulations 151
Ning Wang, David V. Pynadath, and Stacy C. Marsella

Using State Transition Networks to Analyze Multi-party Conversations in a Serious Game 162
Brent Morgan, Fazel Keshtkar, Ying Duan, Padraig Nash, and Arthur Graesser

How to Evaluate Competencies in Game-Based Learning Systems Automatically? 168
Pradeepa Thomas, Jean-Marc Labat, Mathieu Muratet, and Amel Yessad

Content Representation: Empirical Studies

Sense Making Alone Doesn't Do It: Fluency Matters Too! ITS Support for Robust Learning with Multiple Representations 174
Martina A. Rau, Vincent Aleven, Nikol Rummel, and Stacie Rohrbach

Problem Order Implications for Learning Transfer 185
Nan Li, William W. Cohen, and Kenneth R. Koedinger

Knowledge Component Suggestion for Untagged Content in an Intelligent Tutoring System 195
Mario Karlovčec, Mariheida Córdova-Sánchez, and Zachary A. Pardos

Feedback: Empirical Studies

Automating Next-Step Hints Generation Using ASTUS 201
Luc Paquette, Jean-François Lebeau, Gabriel Beaulieu, and André Mayers

The Effectiveness of Pedagogical Agents' Prompting and Feedback in Facilitating Co-adapted Learning with MetaTutor 212
Roger Azevedo, Ronald S. Landis, Reza Feyzi-Behnagh, Melissa Duffy, Gregory Trevors, Jason M. Harley, François Bouchet, Jonathan Burlison, Michelle Taub, Nicole Pacampara, Mohamed Yeasin, A.K.M. Mahbubur Rahman, M. Iftekhar Tanveer, and Gahangir Hossain

Noticing Relevant Feedback Improves Learning in an Intelligent Tutoring System for Peer Tutoring 222
Erin Walker, Nikol Rummel, Sean Walker, and Kenneth R. Koedinger

ITS in Special Domains

Multi-paradigm Generation of Tutoring Feedback in Robotic Arm Manipulation Training 233
Philippe Fournier-Viger, Roger Nkambou, André Mayers, Engelbert Mephu-Nguifo, and Usef Faghihi

User-Centered Design of a Teachable Robot 243
Erin Walker and Winslow Burleson

An Intelligent Tutoring and Interactive Simulation Environment for Physics Learning 250
Lakshman S. Myneni and N. Hari Narayanan

Guru: A Computer Tutor That Models Expert Human Tutors 256
Andrew M. Olney, Sidney D'Mello, Natalie Person, Whitney Cade, Patrick Hays, Claire Williams, Blair Lehman, and Arthur Graesser

Developing an Embodied Pedagogical Agent with and for Young People with Autism Spectrum Disorder 262
Beate Grawemeyer, Hilary Johnson, Mark Brosnan, Emma Ashwin, and Laura Benton

Non Conventional Approaches

WEBsistments: Enabling an Intelligent Tutoring System to Excel at Explaining Rather Than Coaching 268
Yue Gong, Joseph E. Beck, and Neil T. Heffernan

Automated Approaches for Detecting Integration in Student Essays 274
Simon Hughes, Peter Hastings, Joseph Magliano, Susan Goldman, and Kimberly Lawless

On the WEIRD Nature of ITS/AIED Conferences: A 10 Year Longitudinal Study Analyzing Potential Cultural Biases 280
Emmanuel G. Blanchard

Content Representation: Conceptual

Goal-Oriented Conceptualization of Procedural Knowledge 286
Martin Možina, Matej Guid, Aleksander Sadikov, Vida Groznik, and Ivan Bratko

Context-Dependent Help for Novices Acquiring Conceptual Systems Knowledge in DynaLearn 292
Wouter Beek and Bert Bredeweg

Towards an Ontology-Based System to Improve Usability in Collaborative Learning Environments 298
Endhe Elias, Dalgoberto Miquilino, Ig Ibert Bittencourt, Thyago Tenório, Rafael Ferreira, Alan Silva, Seiji Isotani, and Patrícia Jaques

Program Representation for Automatic Hint Generation for a Data-Driven Novice Programming Tutor 304
Wei Jin, Tiffany Barnes, John Stamper, Michael John Eagle, Matthew W. Johnson, and Lorrie Lehmann

Assessment: Constraints

Exploring Quality of Constraints for Assessment in Problem Solving Environments 310
Jaime Galvez Cordero, Eduardo Guzman De Los Riscos, and Ricardo Conejo Muñoz

Can Soft Computing Techniques Enhance the Error Diagnosis Accuracy for Intelligent Tutors? 320
Nguyen-Thinh Le and Niels Pinkwart

Dialogue: Conceptual

Identification and Classification of the Most Important Moments from Students' Collaborative Discourses 330
Costin-Gabriel Chiru and Stefan Trausan-Matu

When Less Is More: Focused Pruning of Knowledge Bases to Improve Recognition of Student Conversation 340
Mark Floryan, Toby Dragon, and Beverly Park Woolf

Coordinating Multi-dimensional Support in Collaborative Conversational Agents 346
David Adamson and Carolyn Penstein Rosé

Textual Complexity and Discourse Structure in Computer-Supported Collaborative Learning 352
Stefan Trausan-Matu, Mihai Dascalu, and Philippe Dessus

Dialogue: Questions

Using Information Extraction to Generate Trigger Questions for Academic Writing Support 358
Ming Liu and Rafael A. Calvo

Learning to Tutor Like a Tutor: Ranking Questions in Context 368
Lee Becker, Martha Palmer, Sarel van Vuuren, and Wayne Ward

Learner Modeling

Analysis of a Simple Model of Problem Solving Times 379
Petr Jarušek and Radek Pelánek

Modelling and Optimizing the Process of Learning Mathematics 389
Tanja Käser, Alberto Giovanni Busetto, Gian-Marco Baschera, Juliane Kohn, Karin Kucian, Michael von Aster, and Markus Gross

The Student Skill Model 399
Yutao Wang and Neil T. Heffernan

Clustered Knowledge Tracing 405
Zachary A. Pardos, Shubhendu Trivedi, Neil T. Heffernan, and Gábor N. Sárközy

Preferred Features of Open Learner Models for University Students 411
Susan Bull

Do Your Eyes Give It Away? Using Eye Tracking Data to Understand Students' Attitudes towards Open Student Model Representations 422
Moffat Mathews, Antonija Mitrovic, Bin Lin, Jay Holland, and Neville Churcher

Fuzzy Logic Representation for Student Modelling: Case Study on Geometry 428
Gagan Goel, Sébastien Lallé, and Vanda Luengo

Learning Detection

Content Learning Analysis Using the Moment-by-Moment Learning Detector 434
Sujith M. Gowda, Zachary A. Pardos, and Ryan S.J.D. Baker

Towards Automatically Detecting Whether Student Learning Is Shallow 444
Ryan S.J.D. Baker, Sujith M. Gowda, Albert T. Corbett, and Jaclyn Ocumpaugh

Item to Skills Mapping: Deriving a Conjunctive Q-matrix from Data . . . 454
Michel C. Desmarais, Behzad Beheshti, and Rhouma Naceur

Interaction Strategies: Games

The Role of Sub-problems: Supporting Problem Solving in Narrative-Centered Learning Environments 464
Lucy R. Shores, Kristin F. Hoffmann, John L. Nietfeld, and James C. Lester

Exploring Inquiry-Based Problem-Solving Strategies in Game-Based Learning Environments 470
Jennifer Sabourin, Jonathan Rowe, Bradford W. Mott, and James C. Lester

Real-Time Narrative-Centered Tutorial Planning for Story-Based Learning 476
Seung Y. Lee, Bradford W. Mott, and James C. Lester

Interaction Strategies: Empirical Studies

An Interactive Teacher's Dashboard for Monitoring Groups in a Multi-tabletop Learning Environment 482
Roberto Martinez Maldonado, Judy Kay, Kalina Yacef, and Beat Schwendimann

Efficient Cross-Domain Learning of Complex Skills 493
Nan Li, William W. Cohen, and Kenneth R. Koedinger

Exploring Two Strategies for Teaching Procedures 499
Antonija Mitrovic, Moffat Mathews, and Jay Holland

Relating Student Performance to Action Outcomes and Context in a Choice-Rich Learning Environment 505
James R. Segedy, John S. Kinnebrew, and Gautam Biswas

Using the MetaHistoReasoning Tool Training Module to Facilitate the Acquisition of Domain-Specific Metacognitive Strategies 511
Eric Poitras, Susanne Lajoie, and Yuan-Jin Hong

An Indicator-Based Approach to Promote the Effectiveness of Teachers' Interventions 517
Aina Lekira, Christophe Després, Pierre Jacoboni, and Dominique Py

Limiting the Number of Revisions while Providing Error-Flagging Support during Tests 524
Amruth N. Kumar

Dialogue: Empirical Studies

Towards Academically Productive Talk Supported by Conversational Agents 531
Gregory Dyke, David Adamson, Iris Howley, and Carolyn Penstein Rosé

Automatic Evaluation of Learner Self-Explanations and Erroneous Responses for Dialogue-Based ITSs 541
Blair Lehman, Caitlin Mills, Sidney D'Mello, and Arthur Graesser

Group Composition and Intelligent Dialogue Tutors for Impacting Students' Academic Self-efficacy 551
Iris Howley, David Adamson, Gregory Dyke, Elijah Mayfield, Jack Beuth, and Carolyn Penstein Rosé

How Do They Do It? Investigating Dialogue Moves within Dialogue Modes in Expert Human Tutoring 557
Blair Lehman, Sidney D'Mello, Whitney Cade, and Natalie Person

Building a Conversational SimStudent 563
Ryan Carlson, Victoria Keiser, Noboru Matsuda, Kenneth R. Koedinger, and Carolyn Penstein Rosé

Predicting Learner's Project Performance with Dialogue Features in Online Q&A Discussions 570
Jaebong Yoo and Jihie Kim

Young Researchers Track

Interventions to Regulate Confusion during Learning 576
Blair Lehman, Sidney D'Mello, and Arthur Graesser

Using Examples in Intelligent Tutoring Systems 579
Amir Shareghi Najar and Antonija Mitrovic

Semi-supervised Classification of Realtime Physiological Sensor Datastreams for Student Affect Assessment in Intelligent Tutoring 582
Keith W. Brawner, Robert Sottilare, and Avelino Gonzalez

Detection of Cognitive Strategies in Reading Comprehension Tasks 585
Terry Peckham

The Effects of Adaptive Sequencing Algorithms on Player Engagement within an Online Game 588
Derek Lomas, John Stamper, Ryan Muller, Kishan Patel, and Kenneth R. Koedinger

A Canonicalizing Model for Building Programming Tutors 591
Kelly Rivers and Kenneth R. Koedinger

Developmentally Appropriate Intelligent Spatial Tutoring for Mobile Devices 594
Melissa A. Wiederrecht and Amy C. Ulinski

Leveraging Game Design to Promote Effective User Behavior of Intelligent Tutoring Systems 597
Matthew W. Johnson, Tomoko Okimoto, and Tiffany Barnes

Design of a Knowledge Base to Teach Programming 600
Dinesha Weragama and Jim Reye

Towards an ITS for Improving Social Problem Solving Skills of ADHD Children 603
Atefeh Ahmadi Olounabadi and Antonija Mitrovic

A Scenario Based Analysis of E-Collaboration Environments 606
Raoudha Chebil, Wided Lejouad Chaari, and Stefano A. Cerri

Supporting Students in the Analysis of Case Studies for Ill-Defined Domains 609
Mayya Sharipova

Using Individualized Feedback and Guided Instruction via a Virtual Human Agent in an Introductory Computer Programming Course 612
Lorrie Lehmann, Dale-Marie Wilson, and Tiffany Barnes

Data-Driven Method for Assessing Skill-Opportunity Recognition in Open Procedural Problem Solving Environments 615
Michael John Eagle and Tiffany Barnes

Posters

How Do Learners Regulate Their Emotions? 618
Amber Chauncey Strain, Sidney D'Mello, and Melissa Gross

A Model-Building Learning Environment with Explanatory Feedback to Erroneous Models 620
Tomoya Horiguchi, Tsukasa Hirashima, and Kenneth D. Forbus

An Automatic Comparison between Knowledge Diagnostic Techniques 622
Sébastien Lallé, Vanda Luengo, and Nathalie Guin

The Interaction Behavior of Agents' Emotional Support and Competency on Learner Outcomes and Perceptions 624
Heather K. Holden

Accuracy of Tracking Student's Natural Language in Operation ARIES!, A Serious Game for Scientific Methods 626
Zhiqiang Cai, Carol Forsyth, Mae-Lynn Germany, Arthur Graesser, and Keith Millis

Designing the Knowledge Base for a PHP Tutor 628
Dinesha Weragama and Jim Reye

Domain Specific Knowledge Representation for an Intelligent Tutoring System to Teach Algebraic Reasoning 630
Miguel Arevalillo-Herráez, David Arnau, José Antonio González-Calero, and Aladdin Ayesh

Exploring the Potential of Tabletops for Collaborative Learning 632
Michael Schubert, Sébastien George, and Audrey Serna

Modeling the Affective States of Students Using SQL-Tutor 634
Thea Faye G. Guia, Ma. Mercedes T. Rodrigo, Michelle Marie C. Dagami, Jessica O. Sugay, Francis Jan P. Macam, and Antonija Mitrovic

A Cross-Cultural Comparison of Effective Help-Seeking Behavior among Students Using an ITS for Math 636
Jose Carlo A. Soriano, Ma. Mercedes T. Rodrigo, Ryan S.J.D. Baker, Amy Ogan, Erin Walker, Maynor Jimenez Castro, Ryan Genato, Samantha Fontaine, and Ricardo Belmontez

Emotions during Writing on Topics That Align or Misalign with Personal Beliefs 638
Caitlin Mills and Sidney D'Mello

A Multiagent-Based ITS Using Multiple Viewpoints for Propositional Logic 640
Evandro Costa, Priscylla Silva, Marlos Silva, Emanuele Silva, and Anderson Santos

Simulation-Based Training of Ill-Defined Social Domains: The Complex Environment Assessment and Tutoring System (CEATS) 642
Benjamin D. Nye, Gnana K. Bharathy, Barry G. Silverman, and Ceyhun Eksin

Empirical Investigation on Self Fading as Adaptive Behavior of Hint Seeking 645
Kazuhisa Miwa, Hitoshi Terai, Nana Kanzaki, and Ryuichi Nakaike

Scripting Discussions for Elaborative, Critical Interactions 647
Oliver Scheuer, Bruce M. McLaren, Armin Weinberger, and Sabine Niebuhr

Design Requirements of a Virtual Learning Environment for Resource Sharing 649
Nikos Barbalios, Irene Ioannidou, Panagiotis Tzionas, and Stefanos Paraskeuopoulos

The Effectiveness of a Pedagogical Agent's Immediate Feedback on Learners' Metacognitive Judgments during Learning with MetaTutor . . . 651
Reza Feyzi-Behnagh and Roger Azevedo

Supporting Students in the Analysis of Case Studies for Professional Ethics Education 653
Mayya Sharipova and Gordon McCalla

Evaluating the Automatic Extraction of Learning Objects from Electronic Textbooks Using ErauzOnt 655
Mikel Larrañaga, Ángel Conde, Iñaki Calvo, Ana Arruarte, and Jon A. Elorriaga

A Cognition-Based Game Platform and Its Authoring Environment for Learning Chinese Characters 657
Chao-Lin Liu, Chia-Ying Lee, Wei-Jie Huang, Yu-Lin Tzeng, and Chia-Ru Chou

Effects of Text and Visual Element Integration Schemes on Online Reading Behaviors of Typical and Struggling Readers 660
Robert P. Dolan and Sonya Powers

Fadable Scaffolding with Cognitive Tool 662
Akihiro Kashihara and Makoto Ito

Mediating Intelligence through Observation, Dependency and Agency in Making Construals of Malaria 664
Meurig Beynon and Will Beynon

Supporting Social Deliberative Skills in Online Classroom Dialogues: Preliminary Results Using Automated Text Analysis 666
Tom Murray, Beverly Park Woolf, Xiaoxi Xu, Stefanie Shipe, Scott Howard, and Leah Wing

Using Time Pressure to Promote Mathematical Fluency 669
Steve Ritter, Tristan Nixon, Derek Lomas, John Stamper, and Dixie Ching

Interoperability for ITS: An Ontology of Learning Style Models 671
Judi McCuaig and Robert Gauthier

Skill Diaries: Can Periodic Self-assessment Improve Students' Learning with an Intelligent Tutoring System? 673
Yanjin Long and Vincent Aleven

An Optimal Assessment of Natural Language Student Input Using Word-to-Word Similarity Metrics 675
Vasile Rus and Mihai Lintean

Facilitating Co-adaptation of Technology and Education through the Creation of an Open-Source Repository of Interoperable Code 677
Philip I. Pavlik Jr., Jaclyn Maass, Vasile Rus, and Andrew M. Olney

A Low-Cost Scalable Solution for Monitoring Affective State of Students in E-learning Environment Using Mouse and Keystroke Data 679
Po-Ming Lee, Wei-Hsuan Tsui, and Tzu-Chien Hsiao

Impact of an Adaptive Tutorial on Student Learning 681
Fethi A. Inan, Fatih Ari, Raymond Flores, Amani Zaier, and Ismahan Arslan-Ari

Technology Enhanced Learning Program That Makes Thinking the Outside to Train Meta-cognitive Skill through Knowledge Co-creation Discussion 683
Kazuhisa Seta, Liang Cui, Mitsuru Ikeda, and Noriyuki Matsuda

Open Student Models to Enhance Blended-Learning 685
Maite Martín, Ainhoa Álvarez, David Reina, Isabel Fernández-Castro, Maite Urretavizcaya, and Susan Bull

ZooQuest: A Mobile Game-Based Learning Application for Fifth Graders 687
Gerard Veenhof, Jacobijn Sandberg, and Marinus Maris

Drawing-Based Modeling for Early Science Education 689
Wouter R. van Joolingen, Lars Bollen, Frank Leenaars, and Hannie Gijlers

An OWL Ontology for IEEE-LOM and OBAA Metadata 691
João Carlos Gluz and Rosa M. Vicari

Classifying Topics of Video Lecture Contents Using Speech Recognition Technology 694
Jun Park and Jihie Kim

An Agent-Based Infrastructure for the Support of Learning Objects Life-Cycle 696
João Carlos Gluz, Rosa M. Vicari, and Liliana M. Passerino

Cluster Based Feedback Provision Strategies in Intelligent Tutoring Systems 699
Sebastian Gross, Xibin Zhu, Barbara Hammer, and Niels Pinkwart

A Web Comic Strip Creator for Educational Comics with Assessable Learning Objectives 701
Fotis Lazarinis and Elaine Pearson

A Layered Architecture for Online Lab-Works: Experimentation in the Computer Science Education 703
Mohamed El Amine Bouabid, Philippe Vidal, and Julien Broisin

A Serious Game for Teaching Conflict Resolution to Children 705
Joana Campos, Henrique Campos, Carlos Martinho, and Ana Paiva

Towards Social Mobile Blended Learning 707
Amr Abozeid, Mohammed Abdel Razek, and Claude Frasson

Learning Looping: From Natural Language to Worked Examples 710
Leigh Ann Sudol-DeLyser, Mark Stehlik, and Sharon Carver

A Basic Model of Metacognition: A Repository to Trigger Reflection ... 712
Alejandro Peña Ayala, Rafael Dominguez de Leon, and Riichiro Mizoguchi

Analyzing Affective Constructs: Emotions 'n Attitudes 714
Ivon Arroyo, David Hilton Shanabrook, Winslow Burleson, and Beverly Park Woolf

Interactive Virtual Representations, Fractions, and Formative Feedback 716
Maria Mendiburo, Brian Sulcer, Gautam Biswas, and Ted Hasselbring

An Intelligent System to Support Accurate Transcription of University Lectures 718
Miltiades Papadopoulos and Elaine Pearson

Multi-context Recommendation in Technology Enhanced Learning 720
Majda Maâtallah and Hassina Seridi-Bouchelaghem

Author Index 723