## Table of Contents

**Adaptive Testing**

A Learning Environment for English for Academic Purposes Based on Adaptive Tests and Task-Based Systems ................................. 1
   *J.P. Gonçalves, S.M. Aluisio, L.H.M. de Oliveira, O.N. Oliveira, Jr.*

A Model for Student Knowledge Diagnosis Through Adaptive Testing ......................................................... 12
   *E. Guzmán, R. Conejo*

A Computer-Adaptive Test That Facilitates the Modification of Previously Entered Responses: An Empirical Study ......................... 22
   *M. Lilley, T. Barker*

**Affect**

An Autonomy-Oriented System Design for Enhancement of Learner’s Motivation in E-learning .................................................... 34
   *E. Blanchard, C. Frasson*

Inducing Optimal Emotional State for Learning in Intelligent Tutoring Systems ................................................................. 45
   *S. Chaffar, C. Frasson*

Evaluating a Probabilistic Model of Student Affect .......................... 55
   *C. Conati, H. Maclare*

Politeness in Tutoring Dialogs: “Run the Factory, That’s What I’d Do” ................................................................. 67
   *W.L. Johnson, P. Rizzo*

Providing Cognitive and Affective Scaffolding Through Teaching Strategies: Applying Linguistic Politeness to the Educational Context ... 77
   *K. Porayska-Pomsta, H. Pain*

**Architectures for ITS**

Knowledge Representation Requirements for Intelligent Tutoring Systems ................................................................. 87
   *I. Hatzilygeroudis, J. Prentzas*

Coherence Compilation: Applying AIED Techniques to the Reuse of Educational TV Resources ................................. 98
   *R. Luckin, J. Underwood, B. du Boulay, J. Holmberg, H. Tunley*
The Knowledge Like the Object of Interaction
in an Orthopaedic Surgery-Learning Environment ........................ 108
  V. Luengo, D. Mufti-Alchawafa, L. Vadcard

Towards Qualitative Accreditation with Cognitive Agents .............. 118
  A. Minko, G. Gouard`eres

Integrating Intelligent Agents, User Models,
and Automatic Content Categorization in a Virtual Environment .... 128
  C. Trojahn dos Santos, F.S. Os´orio

Authoring Systems

EASE: Evolutional Authoring Support Environment ...................... 140
  L. Aroyo, A. Inaba, L. Soldatova, R. Mizoguchi

Selecting Theories in an Ontology-Based ITS Authoring Environment ... 150
  J. Bourdeau, R. Mizoguchi, V. Psych´e, R. Nkambou

Opening the Door to Non-programmers:
Authoring Intelligent Tutor Behavior by Demonstration ................. 162
  K.R. Koedinger, V. Aleven, N. Heffernan, B. McLaren,
  M. Hockenberry

Acquisition of the Domain Structure from Document Indexes
Using Heuristic Reasoning .................................................. 175
  M. Larra˜naga, U. Rueda, J.A. Elorriaga, A. Arruarte

Role-Based Specification of the Behaviour of an Agent
for the Interactive Resolution of Mathematical Problems ............... 187
  M.A. Mora, R. Moriyón, F. Saiz

Lessons Learned from Authoring for Inquiry Learning:
A Tale of Authoring Tool Evolution ...................................... 197
  T. Murray, B. Woolf, D. Marshall

The Role of Domain Ontology in Knowledge Acquisition for ITSs ...... 207
  P. Suraweera, A. Mitrovic, B. Martin

Combining Heuristics and Formal Methods in a Tool
for Supporting Simulation-Based Discovery Learning .................. 217
  K. Veermans, W.R. van Joolingen

Cognitive Modeling

Toward Tutoring Help Seeking
(Applying Cognitive Modeling to Meta-cognitive Skills) ................ 227
  V. Aleven, B. McLaren, I. Roll, K. Koedinger
## Table of Contents

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>E.A. Croteau, N.T. Heffernan, K.R. Koedinger</strong></td>
<td></td>
</tr>
<tr>
<td>Towards Shared Understanding of Metacognitive Skill and Facilitating Its Development</td>
<td>251</td>
</tr>
<tr>
<td><strong>M. Kayashima, A. Inaba, R. Mizoguchi</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Collaborative Learning</strong></td>
<td></td>
</tr>
<tr>
<td>Analyzing Discourse Structure to Coordinate Educational Forums</td>
<td>262</td>
</tr>
<tr>
<td><strong>M.A. Gerosa, M.G. Pimentel, H. Fuks, C. Lucena</strong></td>
<td></td>
</tr>
<tr>
<td>Intellectual Reputation to Find an Appropriate Person for a Role in Creation and Inheritance of Organizational Intellect</td>
<td>273</td>
</tr>
<tr>
<td><strong>Y. Hayashi, M. Ikeda</strong></td>
<td></td>
</tr>
<tr>
<td>Learners’ Roles and Predictable Educational Benefits in Collaborative Learning (An Ontological Approach to Support Design and Analysis of CSCL)</td>
<td>285</td>
</tr>
<tr>
<td><strong>A. Inaba, R. Mizoguchi</strong></td>
<td></td>
</tr>
<tr>
<td>Redefining the Turn-Taking Notion in Mediated Communication of Virtual Learning Communities</td>
<td>295</td>
</tr>
<tr>
<td><strong>P. Reyes, P. Tchounikine</strong></td>
<td></td>
</tr>
<tr>
<td>Harnessing P2P Power in the Classroom</td>
<td>305</td>
</tr>
<tr>
<td><strong>J. Vassileva</strong></td>
<td></td>
</tr>
<tr>
<td>Analyzing Online Collaborative Dialogues: The OXEnTCHÉ-Chat</td>
<td>315</td>
</tr>
<tr>
<td><strong>A.C. Vieira, L. Teixeira, A. Timóteo, P. Tedesco, F. Barros</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Natural Language Dialogue and Discourse</strong></td>
<td></td>
</tr>
<tr>
<td>A Tool for Supporting Progressive Refinement of Wizard-of-Oz Experiments in Natural Language</td>
<td>325</td>
</tr>
<tr>
<td><strong>A. Fiedler, M. Gabsdil, H. Horacek</strong></td>
<td></td>
</tr>
<tr>
<td>Tactical Language Training System: An Interim Report</td>
<td>336</td>
</tr>
<tr>
<td>Combining Competing Language Understanding Approaches in an Intelligent Tutoring System</td>
<td>346</td>
</tr>
<tr>
<td><strong>P.W. Jordan, M. Makatchev, K. VanLehn</strong></td>
<td></td>
</tr>
</tbody>
</table>
Evaluating Dialogue Schemata with the Wizard of Oz
Computer-Assisted Algebra Tutor ........................................... 358
   J.H. Kim, M. Glass

Spoken Versus Typed Human and Computer Dialogue Tutoring .......... 368
   D.J. Litman, C.P. Rosé, K. Forbes-Riley, K. VanLehn,
   D. Bhembe, S. Silliman

Linguistic Markers to Improve the Assessment of Students
in Mathematics: An Exploratory Study ................................... 380
   S. Normand-Assadi, L. Coulange, É. Delozanne, B. Gruegeon

Advantages of Spoken Language Interaction in Dialogue-Based
Intelligent Tutoring Systems .................................................. 390
   H. Pon-Barry, B. Clark, K. Schultz, E.O. Bratt, S. Peters

CycleTalk: Toward a Dialogue Agent That Guides Design
with an Articulate Simulator .................................................. 401
   C.P. Rosé, C. Torrey, V. Aleven, A. Robinson, C. Wu, K. Forbus

DReSDeN: Towards a Trainable Tutorial Dialogue Manager
to Support Negotiation Dialogues for Learning and Reflection ........... 412
   C.P. Rosé, C. Torrey

Combining Computational Models of Short Essay Grading
for Conceptual Physics Problems ............................................. 423
   M.J. Ventura, D.R. Franchescetti, P. Pennumatsa, A.C. Graesser,
   G.T. Jackson, X. Hu, Z. Cai, and the Tutoring Research Group

From Human to Automatic Summary Evaluation .......................... 432
   I. Zipitria, J.A. Elorriaga, A. Arruarte, A.D. de Ilarraza

Evaluation

Evaluating the Effectiveness of a Tutorial Dialogue System
for Self-Explanation ............................................................. 443
   V. Aleven, A. Ogan, O. Popescu, C. Torrey, K. Koedinger

Student Question-Asking Patterns in an Intelligent Algebra Tutor ....... 455

Web-Based Intelligent Multimedia Tutoring
for High Stakes Achievement Tests ......................................... 468
   I. Arroyo, C. Beal, T. Murray, R. Walles, B.P. Woolf

Can Automated Questions Scaffold Children’s Reading Comprehension? .... 478
   J.E. Beck, J. Mostow, J. Bey
# Table of Contents

Web-Based Evaluations Showing Differential Learning for Tutorial Strategies Employed by the Ms. Lindquist Tutor ............... 491  
* N.T. Heffernan, E.A. Croteau

The Impact of Why/AutoTutor on Learning and Retention of Conceptual Physics ............................................. 501  
* G.T. Jackson, M. Ventura, P. Chewle, A. Graesser,  
  and the Tutoring Research Group

ITS Evaluation in Classroom: The Case of Ambre-AWP ..................... 511  
* S. Nogry, S. Jean-Daubias, N. Duclosson

Implicit Versus Explicit Learning of Strategies in a Non-procedural Cognitive Skill ........................................ 521  
* K. VanLehn, D. Bhembe, M. Chi, C. Lynch, K. Schulze,  
  R. Shelby, L. Taylor, D. Treacy, A. Weinstein,  
  M. Wintersgill

**Machine Learning in ITS**

Detecting Student Misuse of Intelligent Tutoring Systems .............. 531  

Applying Machine Learning Techniques to Rule Generation in Intelligent Tutoring Systems .................... 541  
* M.P. Jarvis, G. Nuzzo-Jones, N.T. Heffernan

A Category-Based Self-Improving Planning Module ..................... 554  
* R. Legaspi, R. Sison, M. Numao

AgentX: Using Reinforcement Learning to Improve the Effectiveness of Intelligent Tutoring Systems ....................... 564  
* K.N. Martin, I. Arroyo

An Intelligent Tutoring System Based on Self-Organizing Maps – Design, Implementation and Evaluation ...................... 573  
* W. Martins, S.D. de Carvalho

Modeling the Development of Problem Solving Skills in Chemistry with a Web-Based Tutor ......................... 580  
* R. Stevens, A. Soller, M. Cooper, M. Sprang

**Pedagogical Agents**

Pedagogical Agent Design: The Impact of Agent Realism, Gender, Ethnicity, and Instructional Role ......................... 592  
* A.L. Baylor, Y. Kim
# Table of Contents

Designing Empathic Agents: Adults Versus Kids ............................................. 604  
  L. Hall, S. Woods, K. Dautenhahn, D. Sobral, A. Paiva,  
  D. Wolke, L. Newall

RMT: A Dialog-Based Research Methods Tutor
With or Without a Head ........................................................................ 614  
  P. Wiemer-Hastings, D. Allbritton, E. Arnott

## Student Modeling

Using Knowledge Tracing to Measure Student Reading Proficiencies ........ 624  
  J.E. Beck, J. Sison

The Massive User Modelling System (MUMS) ........................................ 635  
  C. Brooks, M. Winter, J. Greer, G. McCalla

An Open Learner Model for Children and Teachers:  
Inspecting Knowledge Level of Individuals and Peers ............................ 646  
  S. Bull, M. McKay

Scaffolding Self-Explanation to Improve Learning  
in Exploratory Learning Environments. ................................................. 656  
  A. Bunt, C. Conati, K. Muldner

Metacognition in Interactive Learning Environments:  
The Reflection Assistant Model .......................................................... 668  
  C. Gama

Predicting Learning Characteristics  
in a Multiple Intelligence Based Tutoring System .................................. 678  
  D. Kelly, B. Tangney

Alternative Views on Knowledge:  
Presentation of Open Learner Models .................................................. 689  
  A. Mabbott, S. Bull

Modeling Students’ Reasoning About Qualitative Physics:  
Heuristics for Abductive Proof Search ................................................ 699  
  M. Makatchev, P.W. Jordan, K. VanLehn

From Errors to Conceptions – An Approach to Student Diagnosis ............ 710  
  C. Webber

Discovering Intelligent Agent:  
A Tool for Helping Students Searching a Library ................................... 720  
  K. Yammine, M.A. Razek, E. Aimeur, C. Frasson
Teaching and Learning Strategies

Developing Learning by Teaching Environments That Support Self-Regulated Learning ................................. 730
G. Biswas, K. Leelawong, K. Belynne, K. Viswanath, D. Schwartz, J. Davis

Adaptive Interface Methodology for Intelligent Tutoring Systems ......... 741
G. Curilem S., F.M. de Azevedo, A.R. Barbosa

Implementing Analogies in an Electronic Tutoring System ............. 751
E. Lulis, M. Evens, J. Michael

Towards Adaptive Generation of Faded Examples ...................... 762
E. Melis, G. Goguadze

A Multi-dimensional Taxonomy for Automating Hinting ................. 772
D. Tsovaltzi, A. Fiedler, H. Horacek

Poster Papers

Inferring Unobservable Learning Variables from Students’ Help Seeking Behavior ................................. 782
I. Arroyo, T. Murray, B.P. Woolf, C. Beal

The Social Role of Technical Personnel in the Deployment of Intelligent Tutoring Systems ......................... 785

Intelligent Tools for Cooperative Learning in the Internet ............. 788
F. de Almeida Barros, F. Paraguaçu, A. Neves, C.J. Costa

A Plug-in Based Adaptive System: SAAW ............................... 791
L. de Oliveira Brandaõ, S. Isotani, J.G. Moura

Helps and Hints for Learning with Web Based Learning Systems: The Role of Instructions ................................. 794
A. Brunstein, J.F. Krems

Intelligent Learning Environment for Film Reading in Screening Mammography ........................................ 797
J. Campos, P. Taylor, J. Soutter, R. Procter

Reuse of Collaborative Knowledge in Discussion Forums ............. 800
W. Chen

A Module-Based Software Framework for E-learning over Internet Environment ........................................ 803
S.-J. Cho, S. Lee
## Table of Contents

Improving Reuse and Flexibility in Multiagent Intelligent Tutoring System Development Based on the COMPOR Platform  
E. de Barros Costa, H. Oliveira de Almeida, A. Perkusich  

Towards an Authoring Methodology  
in Large-Scale E-learning Environments on the Web  
E. de Barros Costa, R.J.R. dos Santos, A.C. Frery, G. Bittencourt  

ProPAT: A Programming ITS Based on Pedagogical Patterns  
K.V. Delgado, L.N. de Barros  

AMANDA: An ITS for Mediating Asynchronous Group Discussions  
M.A. Eleuterio, F. Bortolozzi  

An E-learning Environment in Cardiology Domain  
E. Ferneda, E. de Barros Costa, H. Oliveira de Almeida,  
L. Matos Brasil, A. Pereira Lima, Jr., G. Millaray Curilem  

Mining Data and Providing Explanation to Improve Learning  
in Geosimulation  
E.V. Filho, V. Pinheiro, V. Furtado  

A Web-Based Adaptive Educational System Where Adaptive Navigation Is Guided by Experience Reuse  
J.-M. Heraud  

Improving Knowledge Representation, Tutoring, and Authoring  
in a Component-Based ILE  
C. Hunn, M. Mavrikis  

A Novel Hybrid Intelligent Tutoring System and Its Use  
of Psychological Profiles and Learning Styles  
W. Martins, F. Ramos de Melo, V. Meireles, L.E.G. Nalini  

Using the Web-Based Cooperative Music Prototyping Environment CODES in Learning Situations  
E.M. Miletto, M.S. Pimenta, L. Costalonga, R. Vicari  

A Multi-agent Approach to Providing Different Forms  
of Assessment in a Collaborative Learning Environment  
M. Mirzarezaee, K. Badie, M. Dehghan, M. Kharrat  

The Overlaying Roles of Cognitive and Information Theories  
in the Design of Information Access Systems  
C. Nakamura, S. Lajoie  

A Personalized Information Retrieval Service  
for an Educational Environment  
L. Nakayama, V. Nóbile de Almeida, R. Vicari
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optimal Emotional Conditions for Learning with an Intelligent Tutoring System</td>
<td>845</td>
</tr>
<tr>
<td>M. Ochs, C. Frasson</td>
<td></td>
</tr>
<tr>
<td>FlexiTrainer: A Visual Authoring Framework for Case-Based Intelligent Tutoring Systems</td>
<td>848</td>
</tr>
<tr>
<td>S. Ramachandran, E. Remolina, D. Fu</td>
<td></td>
</tr>
<tr>
<td>Tutorial Dialog in an Equation Solving Intelligent Tutoring System</td>
<td>851</td>
</tr>
<tr>
<td>L.M. Razzaq, N.T. Heffernan</td>
<td></td>
</tr>
<tr>
<td>A Metacognitive ACT-R Model of Students’ Learning Strategies in Intelligent Tutoring Systems</td>
<td>854</td>
</tr>
<tr>
<td>I. Roll, R.S. Baker, V. Aleven, K.R. Koedinger</td>
<td></td>
</tr>
<tr>
<td>Promoting Effective Help-Seeking Behavior Through Declarative Instruction</td>
<td>857</td>
</tr>
<tr>
<td>I. Roll, V. Aleven, K. Koedinger</td>
<td></td>
</tr>
<tr>
<td>Supporting Spatial Awareness in Training on a Telemanipulator in Space</td>
<td>860</td>
</tr>
<tr>
<td>J. Roy, R. Nkambou, F. Kabanza</td>
<td></td>
</tr>
<tr>
<td>Validating DynMap as a Mechanism to Visualize the Student’s Evolution Through the Learning Process</td>
<td>864</td>
</tr>
<tr>
<td>U. Rueda, M. Larrañaga, J.A. Elorriaga, A. Arruarte</td>
<td></td>
</tr>
<tr>
<td>Qualitative Reasoning in Education of Deaf Students: Scientific Education and Acquisition of Portuguese as a Second Language</td>
<td>867</td>
</tr>
<tr>
<td>H. Salle, P. Salles, B. Bredeweg</td>
<td></td>
</tr>
<tr>
<td>A Qualitative Model of Daniell Cell for Chemical Education</td>
<td>870</td>
</tr>
<tr>
<td>P. Salles, R. Gauche, P. Virmond</td>
<td></td>
</tr>
<tr>
<td>Student Representation Assisting Cognitive Analysis</td>
<td>873</td>
</tr>
<tr>
<td>A. Sergueieva, T.M. Khan</td>
<td></td>
</tr>
<tr>
<td>An Ontology-Based Planning Navigation in Problem-Solving Oriented Learning Processes</td>
<td>877</td>
</tr>
<tr>
<td>K. Seta, K. Tachibana, M. Umano, M. Ikeda</td>
<td></td>
</tr>
<tr>
<td>A Formal and Computerized Modeling Method of Knowledge, User, and Strategy Models in PIModel-Tutor</td>
<td>880</td>
</tr>
<tr>
<td>J. Si</td>
<td></td>
</tr>
<tr>
<td>Title</td>
<td>Page</td>
</tr>
<tr>
<td>----------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>SmartChat – An Intelligent Environment for Collaborative Discussions</td>
<td>883</td>
</tr>
<tr>
<td>S. de Albuquerque Siebra, C. da Rosa Christ, A.E.M. Queiroz,</td>
<td></td>
</tr>
<tr>
<td>P.A. Tedesco, F. de Almeida Barros</td>
<td></td>
</tr>
<tr>
<td>Intelligent Learning Objects: An Agent Based Approach of Learning</td>
<td>886</td>
</tr>
<tr>
<td>Objects</td>
<td></td>
</tr>
<tr>
<td>R.A. Silveira, E.R. Gomes, V.H. Pinto, R.M. Vicari</td>
<td></td>
</tr>
<tr>
<td>Using Simulated Students for Machine Learning</td>
<td>889</td>
</tr>
<tr>
<td>R. Stathacopoulou, M. Grigoriadou, M. Samarakou, G.D. Magoulas</td>
<td></td>
</tr>
<tr>
<td>Towards an Analysis of How Shared Representations Are Manipulated</td>
<td>892</td>
</tr>
<tr>
<td>to Mediate Online Synchronous Collaboration</td>
<td></td>
</tr>
<tr>
<td>D.D. Suthers</td>
<td></td>
</tr>
<tr>
<td>A Methodology for the Construction of Learning Companions</td>
<td>895</td>
</tr>
<tr>
<td>P. Torreão, M. Aquino, P. Tedesco, J. Sá, A. Correia</td>
<td></td>
</tr>
<tr>
<td>Intelligent Learning Environment for Software Engineering Processes</td>
<td>898</td>
</tr>
<tr>
<td>R. Yatchou, R. Nkambou, C. Tangha</td>
<td></td>
</tr>
<tr>
<td>Invited Presentations</td>
<td></td>
</tr>
<tr>
<td>Opportunities for Model-Based Learning Systems in the Human</td>
<td>901</td>
</tr>
<tr>
<td>Exploration of Space</td>
<td></td>
</tr>
<tr>
<td>B. Clancey</td>
<td></td>
</tr>
<tr>
<td>Toward Comprehensive Student Models: Modeling Meta-cognitive Skills and Affective States in ITS</td>
<td>902</td>
</tr>
<tr>
<td>C. Conati</td>
<td></td>
</tr>
<tr>
<td>Having a Genuine Impact on Teaching and Learning – Today and</td>
<td>903</td>
</tr>
<tr>
<td>Tomorrow</td>
<td></td>
</tr>
<tr>
<td>E. Soloway, C. Norris</td>
<td></td>
</tr>
<tr>
<td>Interactively Building a Knowledge Base for a Virtual Tutor</td>
<td>904</td>
</tr>
<tr>
<td>L. Tarouco</td>
<td></td>
</tr>
<tr>
<td>Ontological Engineering and ITS Research</td>
<td>905</td>
</tr>
<tr>
<td>R. Mizoguchi</td>
<td></td>
</tr>
<tr>
<td>Agents Serving Human Learning</td>
<td>906</td>
</tr>
<tr>
<td>S.A. Cerri</td>
<td></td>
</tr>
<tr>
<td>Panels</td>
<td></td>
</tr>
<tr>
<td>Affect and Motivation</td>
<td>907</td>
</tr>
<tr>
<td>W.L. Johnson, C. Conati, B. du Boulay, C. Frasson, H. Pain, K.</td>
<td></td>
</tr>
<tr>
<td>Porayska-Pomsta</td>
<td></td>
</tr>
</tbody>
</table>
Inquiry Learning Environments: Where Is the Field and What Needs to Be Done Next? .................................................. 907
  B. MacLaren, L. Johnson, K. Koedinger, T. Murray, E. Soloway

Towards Encouraging a Learning Orientation
Above a Performance Orientation ........................................... 907
  C.P. Rosé, L. Anthony, R. Baker, A. Corbett, H. Pain,
  K. Porayska-Pomsta, B. Woolf

Workshops

Workshop on Modeling Human Teaching Tactics and Strategies ........ 908
  F. Akhras, B. du Boulay

Workshop on Analyzing Student-Tutor Interaction Logs
to Improve Educational Outcomes ........................................ 909
  J. Beck

Workshop on Grid Learning Services ........................................ 910
  G. Gouardères, R. Nkambou

Workshop on Distance Learning Environments
for Digital Graphic Representation .......................................... 911
  R. Azambuja Silveira, A.B. Almeida da Silva

Workshop on Applications of Semantic Web Technologies
for E-learning ....................................................................... 912
  L. Aroyo, D. Dicheva

Workshop on Social and Emotional Intelligence
in Learning Environments ..................................................... 913
  C. Frasson, K. Porayska-Pomsta

Workshop on Dialog-Based Intelligent Tutoring Systems:
State of the Art and New Research Directions ......................... 914
  N. Heffernan, P. Wiemer-Hastings

Workshop on Designing Computational Models
of Collaborative Learning Interaction ..................................... 915
  A. Soller, P. Jermann, M. Muehlenbrock, A. Martínez Monés

Author Index .............................................................................. 917
Intelligent Tutoring Systems
7th International Conference, ITS 2004, Maceió,
Alagoas, Brazil, August 30 - September 3, 2004,
Proceedings
Lester, J.C.; Vicari, R.M.; Paraguacu, F. (Eds.)
2004, XLII, 920 p., Softcover
ISBN: 978-3-540-22948-3