

Roland T. Mittermeir (Ed.)

LNCS 3422

# From Computer Literacy to Informatics Fundamentals

International Conference on Informatics in Secondary Schools –  
Evolution and Perspectives, ISSEP 2005  
Klagenfurt, Austria, March/April 2005, Proceedings

TP3-53

I93.3

2005

Roland T. Mittermeir (Ed.)

# From Computer Literacy to Informatics Fundamentals

International Conference on Informatics in Secondary Schools –  
Evolution and Perspectives, ISSEP 2005  
Klagenfurt, Austria, March 30 - April 1, 2005  
Proceedings



E200500925



Springer

## Volume Editor

Roland T. Mittermeir  
Universität Klagenfurt  
Institut für Informatik-Systeme  
Universitätsstr. 65-67, 9020 Klagenfurt, Austria  
E-mail: roland@ifi.uni-klu.ac.at

Library of Congress Control Number: 2005922177

CR Subject Classification (1998): K.3, K.4, K.8

ISSN 0302-9743

ISBN 3-540-25336-X Springer Berlin Heidelberg New York

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.

Springer is a part of Springer Science+Business Media

[springeronline.com](http://springeronline.com)

© Springer-Verlag Berlin Heidelberg 2005  
Printed in Germany

Typesetting: Camera-ready by author, data conversion by Scientific Publishing Services, Chennai, India  
Printed on acid-free paper      SPIN: 11407003      06/3142      5 4 3 2 1 0

*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*

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

*University of Dortmund, Germany*

Madhu Sudan

*Massachusetts Institute of Technology, MA, USA*

Demetri Terzopoulos

*New York University, NY, USA*

Doug Tygar

*University of California, Berkeley, CA, USA*

Moshe Y. Vardi

*Rice University, Houston, TX, USA*

Gerhard Weikum

*Max-Planck Institute of Computer Science, Saarbruecken, Germany*

## Preface

Twenty years ago, informatics was introduced as a compulsory subject in Austrian secondary schools. During this period informatics has experienced drastic evolutions and even some shifts of paradigms. This applies to an even larger extent to the didactics of informatics.

*ISSEP - Informatics in Secondary Schools, Evolution and Perspectives* - takes stock of how the developments in the field are reflected in school throughout Europe. Teachers of informatics at secondary schools as well as educators of such teachers propose innovative methods of instruction, discuss the scope of overall informatics instruction, and discuss how innovative concepts can be disseminated to students in education as well as to active informatics teachers.

Due to the penetration of information technology into society at large and into schools in particular, the relationship between informatics and education leading to general computer literacy or to the use of IT-based approaches in conventional subjects, e-learning in school, is an evident focus of many contributions.

According to the broad scope of the conference its proceedings are split into two volumes. This volume, *From Computer Literacy to Informatics Fundamentals*, covers papers reporting on national strategies of informatics instruction and their evolution in accordance with the penetration of information processing equipment in our daily life. In one way or another, these strategies strive to accommodate the needs of basic skills in information and communication technology (ICT) with educational principles that can be conveyed by informatics instruction in a traditional sense. Hence, the papers on national strategies are complemented in two ways: firstly, by contributions that strive to identify fundamental issues, informatics can contribute to the general education process of the youth; and, secondly, by papers presenting approaches on how to link or even to combine instruction about such informatics fundamentals with the need to introduce pupils to the productive use of ICT. The other ISSEP volume, subtitled *Innovative Concepts for Teaching Informatics*, addresses specific didactical models for teaching informatics as well as models of teaching using ICT [1]. Its scope ranges from teacher education via ethics and self-controlled learning to various facets of e-learning.

Out of 51 submissions from 10 countries the program committee selected 16 contributions for publication in this volume. Each paper was reviewed by at least three members of the program committee. The reviewing process and the ensuing discussion were fully electronic.

Thus, this volume, though consisting mainly of contributed papers, is nevertheless the result of an arrangement of papers that aimed in their final versions to specifically contribute to the facet of the program for which they were accepted. The editorial introduction shows how they contribute to the various facets of the conference.

A conference like this is not possible without many hands and brains working for it and without the financial support of gracious donors. Hence, I'd like to thank particularly the members of the program committee, notably those who were keen to review late arrivals or to provide additional help in conflicting situations. Special thanks are also due to the organizing committee led by Peter Micheuz, to Annette Lippitsch for editorial support and administration, as well as to Karin Hodnigg for operating the electronic support of the conference.

The conference was made possible due to the support of several sponsors whose help is gratefully acknowledged. Printing and wide distribution of the two volumes of proceedings was particularly made possible due to a substantial contribution by the Austrian Federal Ministry of Education, Science, and Culture; I'd like to single out particularly Dr. Anton Reiter for his dedicated efforts and creative inputs.

Finally, hosting of the conference by Universität Klagenfurt is gratefully acknowledged. Its facilities and the beautiful surroundings of Carinthia provide the proper setting for a successful event.

January, 2005

Roland Mittermeir

1. Micheuz P., Antonitsch P., Mittermeir R.: Informatics in Secondary Schools – Evolution and Perspectives: Innovative Concepts for Teaching Informatics, Ueberreuter Verlag, Wien, March 2005.

# Organization

ISSEP 2005 was organized by the Institute of Informatics-Systems, Alps-Adria University Klagenfurt, Austria.

## ISSEP Program Committee

Mittermeir, Roland (Chair)	Universität Klagenfurt, Austria
Adam, Hans	BORG Graz, Austria
Böszörményi, Laszlo	Universität Klagenfurt, Austria
Breier, Norbert	Universität Hamburg, Germany
Clark, Martyn	University of Leeds, UK
Dagiene, Valentina	Vilniaus Universitetas, Lithuania
Dorninger, Christian	Bundesministerium für Bildung, Wissenschaft und Kultur, Wien, Austria
Friedrich, Steffen	Technische Universität Dresden, Germany
Fuchs, Karl	Universität Salzburg, Austria
Fullick, Patrick	University of Southampton, UK
Futschek, Gerald	Technische Universität Wien, Austria
Garzotto, Franca	Politecnico di Milano, Italy
Hartmann, Werner	ETH Zürich, Switzerland
Hitz, Martin	Universität Klagenfurt, Austria
Holzinger, Andreas	Medizinische Universität Graz, Austria
Hopfenwieser, Lisbeth	Technische Universität Wien, Austria
Hubwieser, Peter	Technische Universität München, Germany
Knierzinger, Anton	Pädagogische Akademie der Diözese Linz, Austria
Królikowski, Zbyszko	Politechnika Poznanska, Poland
Moreaux, Patrice	Université de Reims, France
Mühlbacher, Jörg	Universität Linz, Austria
Neuwirth, Erich	Universität Wien, Austria
Reiter, Anton	Bundesministerium für Bildung, Wissenschaft und Kultur, Wien, Austria
Schubert, Sigrid	Universität Siegen, Germany
Schauer, Helmut	Universität Zürich, Switzerland
Scheidl, Gerhard	Pädagogisches Institut des Bundes in Wien, Austria

## VIII Organization

Spirin, Oleg	Zhytomyr State Pedagogical University, Ukraine
Waldner, Walter	HTBLA Klagenfurt, Austria
Weissenböck, Martin	HTBLA Rennweg, Wien, Austria

## ISSEP Local Organization

Micheuz, Peter (Chair)	Universität Klagenfurt and Gymnasium Völkermarkt, Austria
Antonitsch, Peter	Universität Klagenfurt and HTL Mössingerstr., Klagenfurt, Austria
Hodnigg, Karin	Universität Klagenfurt, Austria
Lippitsch, Annette	Universität Klagenfurt, Austria

## Main Sponsor

ISSEP 2005 and the publication of its proceedings was supported by bm:bwk, the Austrian Federal Ministry for Education, Science, and Research.



# Lecture Notes in Computer Science

For information about Vols. 1–3331

please contact your bookseller or Springer

Vol. 3452: F. Baader, A. Voronkov (Eds.), *Logic for Programming, Artificial Intelligence, and Reasoning*. XI, 562 pages. 2005. (Subseries LNAI).

Vol. 3448: G.R. Raidl, J. Gottlieb (Eds.), *Evolutionary Computation in Combinatorial Optimization*. XI, 271 pages. 2005.

Vol. 3436: B. Bouyssou, J. Sifakis (Eds.), *Embedded Systems Design*. XV, 492 pages. 2005.

Vol. 3432: M. Beigl, P. Lukowicz (Eds.), *Systems Aspects in Organic and Pervasive Computing - ARCS 2005*. X, 265 pages. 2005.

Vol. 3423: J.L. Fiadeiro, P.D. Mosses, F. Orejas (Eds.), *Recent Trends in Algebraic Development Techniques*. VIII, 271 pages. 2005.

Vol. 3422: R.T. Mittermeir (Ed.), *From Computer Literacy to Informatics Fundamentals*. X, 203 pages. 2005.

Vol. 3419: B. Faltings, A. Petcu, F. Fages, F. Rossi (Eds.), *Constraint Satisfaction and Constraint Logic Programming*. X, 217 pages. 2005. (Subseries LNAI).

Vol. 3418: U. Brandes, T. Erlebach (Eds.), *Network Analysis*. XII, 471 pages. 2005.

Vol. 3416: M. Böhlen, J. Gamper, W. Polasek, M.A. Wimmer (Eds.), *E-Government: Towards Electronic Democracy*. XIII, 311 pages. 2005. (Subseries LNAI).

Vol. 3415: P. Davidsson, B. Logan, K. Takadama (Eds.), *Multi-Agent and Multi-Agent-Based Simulation*. X, 265 pages. 2005. (Subseries LNAI).

Vol. 3414: M. Morari, L. Thiele (Eds.), *Hybrid Systems: Computation and Control*. XII, 684 pages. 2005.

Vol. 3412: X. Franch, D. Port (Eds.), *COTS-Based Software Systems*. XVI, 312 pages. 2005.

Vol. 3411: S.H. Myaeng, M. Zhou, K.-F. Wong, H.-J. Zhang (Eds.), *Information Retrieval Technology*. XIII, 337 pages. 2005.

Vol. 3410: C.A. Coello Coello, A. Hernández Aguirre, E. Zitzler (Eds.), *Evolutionary Multi-Criterion Optimization*. XVI, 912 pages. 2005.

Vol. 3409: N. Guelfi, G. Reggio, A. Romanovsky (Eds.), *Scientific Engineering of Distributed Java Applications*. X, 127 pages. 2005.

Vol. 3408: D.E. Losada, J.M. Fernández-Luna (Eds.), *Advances in Information Retrieval*. XVII, 572 pages. 2005.

Vol. 3407: Z. Liu, K. Araki (Eds.), *Theoretical Aspects of Computing - ICTAC 2004*. XIV, 562 pages. 2005.

Vol. 3406: A. Gelbukh (Ed.), *Computational Linguistics and Intelligent Text Processing*. XVII, 829 pages. 2005.

Vol. 3404: V. Diekert, B. Durand (Eds.), *STACS 2005*. XVI, 706 pages. 2005.

Vol. 3403: B. Ganter, R. Godin (Eds.), *Formal Concept Analysis*. XI, 419 pages. 2005. (Subseries LNAI).

Vol. 3401: Z. Li, L.G. Vulkov, J. Waśniewski (Eds.), *Numerical Analysis and Its Applications*. XIII, 630 pages. 2005.

Vol. 3398: D.-K. Baik (Ed.), *Systems Modeling and Simulation: Theory and Applications*. XIV, 733 pages. 2005. (Subseries LNAI).

Vol. 3397: T.G. Kim (Ed.), *Artificial Intelligence and Simulation*. XV, 711 pages. 2005. (Subseries LNAI).

Vol. 3396: R.M. van Eijk, M.-P. Huget, F. Dignum (Eds.), *Agent Communication*. X, 261 pages. 2005. (Subseries LNAI).

Vol. 3395: J. Grabowski, B. Nielsen (Eds.), *Formal Approaches to Software Testing*. X, 225 pages. 2005.

Vol. 3394: D. Kudenko, D. Kazakov, E. Alonso (Eds.), *Adaptive Agents and Multi-Agent Systems III*. VIII, 313 pages. 2005. (Subseries LNAI).

Vol. 3393: H.-J. Kreowski, U. Montanari, F. Orejas, G. Rozenberg, G. Taentzer (Eds.), *Formal Methods in Software and Systems Modeling*. XXVII, 413 pages. 2005.

Vol. 3391: C. Kim (Ed.), *Information Networking*. XVII, 936 pages. 2005.

Vol. 3390: R. Choren, A. Garcia, C. Lucena, A. Romanovsky (Eds.), *Software Engineering for Multi-Agent Systems III*. XII, 291 pages. 2005.

Vol. 3389: P. Van Roy (Ed.), *Multiparadigm Programming in Mozart/OZ*. XV, 329 pages. 2005.

Vol. 3388: J. Lagergren (Ed.), *Comparative Genomics*. VIII, 133 pages. 2005. (Subseries LNBI).

Vol. 3387: J. Cardoso, A. Sheth (Eds.), *Semantic Web Services and Web Process Composition*. VIII, 147 pages. 2005.

Vol. 3386: S. Vaudenay (Ed.), *Public Key Cryptography - PKC 2005*. IX, 436 pages. 2005.

Vol. 3385: R. Cousot (Ed.), *Verification, Model Checking, and Abstract Interpretation*. XII, 483 pages. 2005.

Vol. 3383: J. Pach (Ed.), *Graph Drawing*. XII, 536 pages. 2005.

Vol. 3382: J. Odell, P. Giorgini, J.P. Müller (Eds.), *Agent-Oriented Software Engineering V*. X, 239 pages. 2005.

Vol. 3381: P. Vojtáš, M. Bieliková, B. Charron-Bost, O. Sýkora (Eds.), *SOFSEM 2005: Theory and Practice of Computer Science*. XV, 448 pages. 2005.

Vol. 3379: M. Hemmje, C. Niederee, T. Risse (Eds.), *From Integrated Publication and Information Systems to Information and Knowledge Environments*. XXIV, 321 pages. 2005.

- Vol. 3378: J. Kilian (Ed.), *Theory of Cryptography*. XII, 621 pages. 2005.
- Vol. 3377: B. Goethals, A. Siebes (Eds.), *Knowledge Discovery in Inductive Databases*. VII, 190 pages. 2005.
- Vol. 3376: A. Menezes (Ed.), *Topics in Cryptology – CT-RSA 2005*. X, 385 pages. 2005.
- Vol. 3375: M.A. Marsan, G. Bianchi, M. Listanti, M. Meo (Eds.), *Quality of Service in Multiservice IP Networks*. XIII, 656 pages. 2005.
- Vol. 3374: D. Weyns, H.V.D. Parunak, F. Michel (Eds.), *Environments for Multi-Agent Systems*. X, 279 pages. 2005. (Subseries LNAI).
- Vol. 3372: C. Bussler, V. Tannen, I. Fundulaki (Eds.), *Semantic Web and Databases*. X, 227 pages. 2005.
- Vol. 3371: M.W. Barley, N. Kasabov (Eds.), *Intelligent Agents and Multi-Agent Systems*. X, 329 pages. 2005. (Subseries LNAI).
- Vol. 3370: A. Konagaya, K. Satou (Eds.), *Grid Computing in Life Science*. X, 188 pages. 2005. (Subseries LNBI).
- Vol. 3369: V.R. Benjamins, P. Casanovas, J. Breuker, A. Gangemi (Eds.), *Law and the Semantic Web*. XII, 249 pages. 2005. (Subseries LNAI).
- Vol. 3368: L. Paletta, J.K. Tsotsos, E. Rome, G.W. Humphreys (Eds.), *Attention and Performance in Computational Vision*. VIII, 231 pages. 2005.
- Vol. 3367: W.S. Ng, B.C. Ooi, A. Oukel, C. Sartori (Eds.), *Databases, Information Systems, and Peer-to-Peer Computing*. X, 231 pages. 2005.
- Vol. 3366: I. Rahwan, P. Moraitis, C. Reed (Eds.), *Argumentation in Multi-Agent Systems*. XII, 263 pages. 2005. (Subseries LNAI).
- Vol. 3365: G. Mauri, G. Păun, M.J. Pérez-Jiménez, G. Rozenberg, A. Salomaa (Eds.), *Membrane Computing*. IX, 415 pages. 2005.
- Vol. 3363: T. Eiter, L. Libkin (Eds.), *Database Theory – ICDT 2005*. XI, 413 pages. 2004.
- Vol. 3362: G. Barthe, L. Burdy, M. Huisman, J.-L. Lanet, T. Muntean (Eds.), *Construction and Analysis of Safe, Secure, and Interoperable Smart Devices*. IX, 257 pages. 2005.
- Vol. 3361: S. Bengio, H. Bourlard (Eds.), *Machine Learning for Multimodal Interaction*. XII, 362 pages. 2005.
- Vol. 3360: S. Spaccapietra, E. Bertino, S. Jajodia, R. King, D. McLeod, M.E. Orlowska, L. Strous (Eds.), *Journal on Data Semantics II*. XI, 223 pages. 2005.
- Vol. 3359: G. Grieser, Y. Tanaka (Eds.), *Intuitive Human Interfaces for Organizing and Accessing Intellectual Assets*. XIV, 257 pages. 2005. (Subseries LNAI).
- Vol. 3358: J. Cao, L.T. Yang, M. Guo, F. Lau (Eds.), *Parallel and Distributed Processing and Applications*. XXIV, 1058 pages. 2004.
- Vol. 3357: H. Handschuh, M.A. Hasan (Eds.), *Selected Areas in Cryptography*. XI, 354 pages. 2004.
- Vol. 3356: G. Das, V.P. Gulati (Eds.), *Intelligent Information Technology*. XII, 428 pages. 2004.
- Vol. 3355: R. Murray-Smith, R. Shorten (Eds.), *Switching and Learning in Feedback Systems*. X, 343 pages. 2005.
- Vol. 3354: M. Margenstern (Ed.), *Machines, Computations, and Universality*. VIII, 329 pages. 2005.
- Vol. 3353: J. Hromkovič, M. Nagl, B. Westfechtel (Eds.), *Graph-Theoretic Concepts in Computer Science*. XI, 404 pages. 2004.
- Vol. 3352: C. Blundo, S. Cimato (Eds.), *Security in Communication Networks*. XI, 381 pages. 2005.
- Vol. 3351: G. Persiano, R. Solis-Oba (Eds.), *Approximation and Online Algorithms*. VIII, 295 pages. 2005.
- Vol. 3350: M. Hermenegildo, D. Cabeza (Eds.), *Practical Aspects of Declarative Languages*. VIII, 269 pages. 2005.
- Vol. 3349: B.M. Chapman (Ed.), *Shared Memory Parallel Programming with Open MP*. X, 149 pages. 2005.
- Vol. 3348: A. Canteaut, K. Viswanathan (Eds.), *Progress in Cryptology – INDOCRYPT 2004*. XIV, 431 pages. 2004.
- Vol. 3347: R.K. Ghosh, H. Mohanty (Eds.), *Distributed Computing and Internet Technology*. XX, 472 pages. 2004.
- Vol. 3346: R.H. Bordini, M. Dastani, J. Dix, A.E.F. Seghrouchni (Eds.), *Programming Multi-Agent Systems*. XIV, 249 pages. 2005. (Subseries LNAI).
- Vol. 3345: Y. Cai (Ed.), *Ambient Intelligence for Scientific Discovery*. XII, 311 pages. 2005. (Subseries LNAI).
- Vol. 3344: J. Malenfant, B.M. Østvold (Eds.), *Object-Oriented Technology. ECOOP 2004 Workshop Reader*. VIII, 215 pages. 2005.
- Vol. 3343: C. Freksa, M. Knauff, B. Krieg-Brückner, B. Nebel, T. Barkowsky (Eds.), *Spatial Cognition IV. Reasoning, Action, and Interaction*. XIII, 519 pages. 2005. (Subseries LNAI).
- Vol. 3342: E. Şahin, W.M. Spears (Eds.), *Swarm Robotics*. IX, 175 pages. 2005.
- Vol. 3341: R. Fleischer, G. Trippen (Eds.), *Algorithms and Computation*. XVII, 935 pages. 2004.
- Vol. 3340: C.S. Calude, E. Calude, M.J. Dinneen (Eds.), *Developments in Language Theory*. XI, 431 pages. 2004.
- Vol. 3339: G.I. Webb, X. Yu (Eds.), *AI 2004: Advances in Artificial Intelligence*. XXII, 1272 pages. 2004. (Subseries LNAI).
- Vol. 3338: S.Z. Li, J. Lai, T. Tan, G. Feng, Y. Wang (Eds.), *Advances in Biometric Person Authentication*. XVIII, 699 pages. 2004.
- Vol. 3337: J.M. Barreiro, F. Martin-Sanchez, V. Maojo, F. Sanz (Eds.), *Biological and Medical Data Analysis*. XI, 508 pages. 2004.
- Vol. 3336: D. Karagiannis, U. Reimer (Eds.), *Practical Aspects of Knowledge Management*. X, 523 pages. 2004. (Subseries LNAI).
- Vol. 3335: M. Malek, M. Reitspieß, J. Kaiser (Eds.), *Service Availability*. X, 213 pages. 2005.
- Vol. 3334: Z. Chen, H. Chen, Q. Miao, Y. Fu, E. Fox, E.-p. Lim (Eds.), *Digital Libraries: International Collaboration and Cross-Fertilization*. XX, 690 pages. 2004.
- Vol. 3333: K. Aizawa, Y. Nakamura, S. Satoh (Eds.), *Advances in Multimedia Information Processing – PCM 2004, Part III*. XXXV, 785 pages. 2004.
- Vol. 3332: K. Aizawa, Y. Nakamura, S. Satoh (Eds.), *Advances in Multimedia Information Processing – PCM 2004, Part II*. XXXVI, 1051 pages. 2004.

# Table of Contents

Introduction	1
<i>Roland T. Mittermeir</i> .....	
<b>20 Years of Informatics in Austrian Secondary Schools</b>	
Incorporation of Informatics in Austrian Education: The Project “Computer-Education-Society” in the School Year 1984/85	4
<i>Anton Reiter</i> .....	
20 Years of Computers and Informatics in Austria’s Secondary Academic Schools	20
<i>Peter Micheuz</i> .....	
Informatics Education at Vocational Schools and Colleges in Austria	32
<i>Martin Weissenböck</i> .....	
<b>National Perspectives</b>	
The Transition from School to University: Would Prior Study of Computing Help?	37
<i>Martyn Clark, Roger Boyle</i> .....	
Informatics and ICT in Polish Education System	46
<i>Ewa Gurbiel, Grazyna Hardt-Olejniczak, Ewa Kolczyk, Helena Krupicka, Maciej M. Syslo</i> .....	
Teaching Information Technology in General Education: Challenges and Perspectives	53
<i>Valentina Dagienė</i> .....	
Educational Standards in School Informatics in Austria	65
<i>Christian Dorninger</i> .....	
Russian Educational Standards of Informatics and Informatics Technologies (ICT): Aims, Content, Perspectives	70
<i>Aleksandr A. Kuznetsov, Sergey A. Beshenkov</i> .....	
The Present-Day Tendencies of Teaching Informatics in Ukraine	75
<i>Oleg Spirin</i> .....	

Study of Information Search Systems of the Internet <i>Yuri Ramsky, Olga Rezina</i> .....	84
--	----

## Fundamentals Versus ICT

Why Teach Introductory Computer Science? Reconciling Diverse Goals and Expectations <i>Jürg Nievergelt</i> .....	92
Teaching: People to People - About People <i>A Plea for the Historic and Human View</i> <i>Laszlo Böszörményi</i> .....	93
Preparatory Knowledge: Propaedeutic in Informatics <i>Susanne Loidl, Jörg Mühlbacher, Helmut Schauer</i> .....	104
A Pragmatic Approach to Spreadsheet Training Based Upon the "Projection-Screen" Model <i>Karin Hodnigg</i> .....	116
A Strategy to Introduce Functional Data Modeling at School Informatics <i>Markus Schneider</i> .....	130
Informatic Models in Vocational Training for Teaching Standard Software <i>Siglinde Voß</i> .....	145
Evolving Boxes as Flexible Tools for Teaching High-School Students Declarative and Procedural Aspects of Logic Programming <i>Bruria Haberman, Zahava Scherz</i> .....	156
The Role of ICT and Informatics in Austria's Secondary Academic Schools <i>Peter Micheuz</i> .....	166
Informatics Versus Information Technology - How Much Informatics Is Needed to Use Information Technology - A School Perspective <i>Maciej M. Sysło, Anna Beata Kwiatkowska</i> .....	178
Standard Software as Microworld? <i>Peter K. Antonitsch</i> .....	189
The Future Is Mobile - Education Meets Mobile Communication <i>Werner Wiedermann</i> .....	198
Author Index .....	203

# Introduction

Roland T. Mittermeir

Institut für Informatik-Systeme  
Universität Klagenfurt  
9020 Klagenfurt, AUSTRIA  
roland@isys.uni-klu.ac.at

The external motivation to organize a conference on Informatics in Secondary Schools with specific focus on the Evolution and Perspective of School Informatics was an anniversary. 1985 informatics instruction was introduced in secondary academic schools (AHS) in Austria as an independent subject. It encompassed two credit hours of basic informatics instruction in the 5<sup>th</sup> form (age group 14 – 15 years old) and possible electives thereafter. A few years later, electives in informatics could be chosen even at lower grades.

To account for this fact, the opening keynote is given by three pioneers who have been instrumental in the formation of school informatics and who helped to shape the subject in its initial twenty years. *Anton Reiters* contribution tells from a ministerial perspective how this came all about. *Peter Micheuz*' very personal contribution shows how these developments are perceived from the perspective of a practicing teacher. The differentiating nuances between the perceptions reported in these contributions are probably not too specific for a particular country.

Since Austria's secondary school systems is structured into two huge blocks, the (general, humanistic) academic secondary schools (AHS, i.e. *Allgemeinbildende Höhere Schulen*) and vocational secondary schools (BHS, i.e. *Berufsbildende Höhere Schulen*), Micheuz' contribution is complemented by *Martin Weissenböck's* paper explaining the details of the highly structured and, therefore, relatively inhomogeneous block of BHS's. This highly structured system of vocational secondary schools is a distinct characteristic of the Austrian school system. As the system of vocational schools covers a broad spectrum, the role of informatics in these schools varies accordingly. It ranges from special engineering curricula in informatics which have already a substantial tradition to rather non-technical curricula, where informatics is rather seen as data processing or as web design.

The next block of papers gives an account of various national perspectives on informatics instruction and its introduction into curricula of secondary schools. In light of the current enlargement of the European Union towards the East, special focus is laid on countries which joined the union recently or which are even a step further to the East. This block is opened by *Martyn Clark* and *Roger Boyles* investigation, whether and what kind prior informatics instruction would help students to succeed in entry level exams to British universities. Next, *Ewa Gurbiel* and her colleagues report on a reform of the Polish school system. It led to the introduction of informatics related content, ranging from informatics proper via ICT to computer support in traditional subjects. The paper explains how informatics related education is spread over the various levels of the educational system. Remaining in northeastern Europe,

*Valentina Dagiene* describes the contents of Informatics instruction in Lithuania. There, from the 9<sup>th</sup> to the 12<sup>th</sup> form students get a rather rich spectrum of compulsory ICT and informatics instruction with optional extensions in the two uppermost grades.

The tension between application oriented ICT and the aim of conveying fundamental principles of informatics to students is further highlighted by *Christian Dorninger's* arguments calling for standardization. It is certainly up for debate, to which extent general schools should apply company-specific standards as their yardstick. Critics should admit though, that in spite of currently popular instances, educational standards might in principle be established for contents of exclusively fundamental nature as well. Establishing such standards would just require agreement on a list encompassing such fundamentals. Dorninger's recommendations attempt the range from basic skills to technical specialties taught at the university level. This implies already that the standards mentioned have to be methodologically much richer than what comes to mind when thinking about ECDL.

*Aleksandr Kuznetsov* and *Sergey Beshenkov* allow a glimpse at Russian informatics instruction from basic up to university levels. Derived from theoretical principles, a list of topics and related instructional processes is presented.

Two Ukrainian papers complete this section. *Oleg Spirin* shows how hardware constraints influence the curricula of Ukrainian schools and how they can be overcome at least to a certain extent. The paper also informs about the actualization of informatics competences of teachers, an aspect relevant all over the world. Another paper showing how to cope with limitations is *Yuri Ramsky* and *Olga Rezina's* account of introducing Ukrainian students to internet search. The West-European perspective of the internet as an infinite world-wide library has to be at least slightly adjusted, when realizing that these pupils native language is written in a different script. Realizing these limitations might, on the other hand, remind us that the west-centric perspective on Latin script and English language provides also only a very truncated view of the world. Further, we rather don't imagine creating a search system to simulate internet search in order to prepare even those pupils for modern information retrieval where scarcity of resources prohibits interconnection to the real web.

Summarizing these national perspectives one witnesses that the penetration of personal computing and the (almost) ubiquitous presence of certain types of application software had substantial effects on the shape of what was introduced as informatics instruction. Principles of abstraction and algorithmization gave way to intellectually less rewarding topics such as using a text processing system to write a letter or using spreadsheets to perform some calculations which were never meant to be done by such tools when the tool was invented.

The dispute centers quite often on the role of programming in informatics instruction. The arguments supporting programming changed over the years. Algorithmization, the necessity to formulate extremely precise, the capability of modeling, the need to anticipate consequences of commands and the need to think in alternative branches is just an incomplete list of arguments. Nevertheless, programming is undoubtedly a distinctive characteristic of computing and informatics as argued by *Jürg Nievergelt* in his keynote opening the discussion about *Fundamentals*. Programming must not capture all of the attention of informatics instruction though.

How broad the discussion about fundamentals can be conducted is shown by *Laszlo Böszörményis* paper. Certainly in agreement with the mainstream of informatics educators about the final goals of informatics instruction, he argues to give plastic-

ity to the current body of knowledge deemed appropriate for school by teaching from a historical perspective. This should allow pupils to share part of the excitement created by the inventions once made by the masters of the discipline. In comparison, *Susanne Loidl*, *Jörg Mühlbacher* and *Helmut Schauer* approach fundamental topics in a less controversial way. The distinctive feature of this paper is the simplicity of examples the authors are proposing in order to demonstrate pupils highly complex fundamentals of the discipline. Using e-learning supportas mentioned might allow engraining these concepts so that they are also retained by students.

The next set of papers presents approaches to avoid what sometimes is mentioned as conflicting goals: basic ICT training and informatics-instruction proper. *Karin Hodnigg* presents spreadsheets beyond the tool aspect. Her focus is not on tips and tricks relating to the individual cell but on the perspective of the sheet as a huge computing space with scoping and data-flows, hence on a programming plane. Her projection-screen model seems intuitive and overcomes some inconsistencies one runs into when explaining spreadsheets with the broadly known semantic models of programming. *Markus Schneider* dwells also on the perspective that filling in spreadsheets is programming. To do this in a methodological way, he proposes functional data flow modeling. This not only combines ICT-aspects with software engineering concepts. It also proposes a methodology for systematic spreadsheet development that leads to a relationship between layout and semantics. *Siglinde Voss* shows how to introduce object-orientation based on word processing software. Taken together, these three papers show how multifaceted programming can be and how different the approaches to teach its discipline are. The spectrum opened by these papers is further widened by *Bruria Haberman* and *Zahava Scherz's* contribution. Building on already existing programming knowledge, their approach introduces component based software development with the full spectrum from specification comprehension and specification writing to black box and white box reuse of ADT's. Their approach conveys the declarative and procedural aspects of logic programming. It puts apparently also substantial emphasis on code reading, an aspect neglected in most approaches.

The papers by *Peter Micheuz* and by *Maciej Syslo et al* come back to the issue of the transition from ICT to informatics from the vantage point of two different educational systems. While *Peter Micheuz* argues to subsume ICT in a broad framework of informatics related instruction, *Maciej Syslo* and *Beata Kwiatowska* explain why the various IT-related facets of education are kept separate in Poland. They also report on principles of peer-guided, self-organized training of fellow teachers to raise their competences in integrating information technology in their teaching activity. *Peter Antonitsch*, on the other hand, addresses a procedural didactical issue when discussing the pros and cons of using either highly specialized instructional environments or micro-worlds when teaching programming. It might be surprising that he resolves the dispute by finally proposing an ICT solution to solve the problem.

The volume concludes with a contribution of *Werner Wiedermann*, reporting on developments in the telecommunication industry and their impact on learning in mobile contexts. His keynote leads the way to eLearning and mLearning, topics beyond informatics instruction, and therefore discussed in the accompanying volume. But nevertheless, currently, these topics are still to a large extent within the scope of informatics teachers or at least in the scope of educational projects where informatics teachers are members of the educational team.

# Incorporation of Informatics in Austrian Education: The Project “Computer-Education-Society” in the School Year 1984/85

Anton Reiter

Federal Ministry of Education, Science and Culture,  
Vienna, Austria  
Anton.Reiter@bmbwk.gv.at

**Abstract.** Effects of information technology on economy, society and education were discussed already at the beginning of the 1980's. The German computer scientist Klaus Haefner even predicted an educational crisis caused by the penetration of information technology into our lives. When the personal computer became the “machine of the year 1985”, politicians and educators in the industrialized countries proclaimed “computer literacy” as an essential part of education and demanded the integration of new technologies into the curriculum.

This paper describes the comprehensive instruction project “Computer-Education-Society” of the school year 1984/85, launched by the Austrian Federal Ministry of Education, Arts and Sports<sup>1</sup> on the background of the author's personal involvement as a permanent speaker at the central teacher seminars in Vienna and as a historical dedication to the 20<sup>th</sup> anniversary of the implementation of the subject *Informatics* at the compulsory secondary general school (AHS).

## 1 Introductory Remarks

The rather frightening predictions in George Orwell's well known book “1984” that our lives would be affected, modified and even governed (“Big Brother”) more and more significantly by new information (and communication) technologies<sup>2</sup> (in recent literature usually abbreviated with NICTs), might have had some effects on Austrian policy-makers. They considered it as duty of the government's education system to adequately prepare the young people of the 1980's for a life in the so-called post industrial era, a forthcoming technologically advanced information society.

Within two decades the NICTs have changed the world of work and sciences, daily life and our educational system. Computers accomplish tasks of the human intellect

---

<sup>1</sup> Currently: Federal Ministry of Education, Science and Culture (*Bundesministerium für Bildung, Wissenschaft und Kultur*).

<sup>2</sup> It's a matter of fact that in many (recent) publications the term “new information and communication technology” (NICT) is not precisely defined or explained. In most cases it refers to the use of computers, multimedia and telecommunication as tools for teaching and learning. But it also has relevance to the subject *informatics* or *computer science*. During the early 1980's the communication aspect played a minor role. The PC was predominantly available as stand alone device.



with high efficiency and reliability and they can be linked together to form extensive electronic systems of information and communication. The world's largest and most famous electronic network - the Internet (WWW) - has got an outstanding relevance not only for the field of education [10, 16] but also for the economy and daily life in the industrialized countries. That's why any educational policy has to meet the challenges of the NICTs and to take them into account when discussing future aspects of teaching and learning.

## 2 The New Education Crisis

The German computer scientist Klaus Haefner<sup>3</sup>, speaker at worldwide IFIP<sup>4</sup> conferences, raised doubts about the contemporary educational system. He saw the educational system as moving too slowly towards information technology (IT) in general. In the beginning of the 1980s he stated: "Since more and more information processing is being transferred from human brains into the information technology, the presented role of the educational system will be questioned." [12, p. 525] Education would have to change drastically the way to prepare students of all ages for their future role in society, Haefner demanded.

Looking ahead many activities up to now still performed by humans would be taken over by technology, he argued. Instead of human hands, robots would manipulate materials. The low costs benefit ratio of information technology would make it possible to use automated production. Human activity would then be shifted into control activities. People would prefer technical information processing in professional as well as in private applications because it would be more economic, available around the clock, more reliable, and much faster compared with human information handling. Education would have to be adapted quickly or it would run the risk of misqualifying people, Haefner warned.

But in the beginning of the 1980s, he could justifiably claim that "politicians, administrators and teachers presently behave in a way as if information technology does not exist at all. The overall goals of the public educational system have been basically unmodified for decades. It is still the intention of 99 percent of all curricula to educate the autonomous human brain as the sole source of information storage and information processing." [4, p. 973] The human brain would be challenged by the growth of information technology and subject to competition of information processing systems. Humans as information processors would be in fact often not needed anymore, since there was a growing choice of using information technology instead.

To overcome the crisis mentioned in time, Haefner recommended as invited speaker in the House of the Association of Industrialists in Vienna in 1984 and the following years certain educational goals [14]. His recommendations reached from the necessity to understand the forthcoming changes in society as impact of IT via the demand to bring IT into the class for proper use up to the development and

<sup>3</sup> His book "Die neue Bildungskrise" [13] became a bestseller.

<sup>4</sup> International Federation for Information Processing – the IFIP secretariat is in Laxenburg close to Vienna ([www.ifip.or.at](http://www.ifip.or.at)).