

ABOUT THE CONTRIBUTORS

Prof. dr. Betty Collis is head of the research team “Technology for Strategy, Learning and Change” in the Faculty of Behavioural Sciences at the University of Twente in The Netherlands. In addition, as leader of a five-year collaborative research project with the Learning and Leadership Development Organization of Shell International Exploration and Production (Shell EP-LLD), she is also head of the research team for Shell EP LLD. In both roles she applies, researches, and evaluates the contribution-oriented pedagogy. See <http://users.edte.utwente.nl/collis/> for an overview of her work.

Dr. Cathy Gunn is a Senior Lecturer in Academic Development for e-Learning at the University of Auckland in New Zealand. Her role involves a variety of teaching, research, strategic planning, organizational development and educational consultancy activities, all aimed at promoting the integration of technology to enhance learning, teaching and administration across the institution. Cathy is currently serving a two-year term as President of ascilite, (The Australasian Society for Computers in Learning in Tertiary Education) and is recognized internationally as an expert in this emerging discipline.

Professor John Hedberg is Millennium Innovations Chair in ICT and Education & Director of the Macquarie ICT Innovations Centre at Macquarie University, Sydney, Australia. Macquarie ICT Innovations Centre is a learning partnership with the NSW Department of Education and Training to develop innovative programs in technology enhanced learning for students and teachers. He was previously Professor of Learning Sciences and Technologies at Nanyang Technological University in Singapore where he directed several research projects exploring the role of technologies in engaging students in Mathematics, Science, History and Geography classrooms. He is known for the constructivist learning environments he has designed culminating in a British Academy award for an interactive theatre CD-ROM entitled *StageStruck*. He has wide experience in the

design of open and distance learning programs delivered on-line and through CD-ROM. He has published on navigation, cognition and multimodality, design and evaluation in interactive multimedia, the most recent book is *Evaluating interactive learning systems* with Thomas Reeves has been recently published by Educational Technology publications, He is also the Editor-in-chief of *Educational Media International*.

Dr. David Hung is an associate professor at the National Institute of Education (NIE), Nanyang Technological University, Singapore. He is currently a contributing editor of *Educational Technology* and an associate editor of the *International Journal of Learning Technology*. Dr. Hung teaches and supervises students of both undergraduate and graduate levels; and serves as a consultant and trainer to various projects involving education and training, initiated by the Ministry of Education and the Ministry of Defense. Besides being involved in research on the cognitive and learning sciences, Dr. Hung has been actively involved in online learning efforts in NIE and in Singapore.

David Jonassen is Distinguished Professor of Education at the University of Missouri where he teaches in the areas of Learning Technologies and Educational Psychology. Since earning his doctorate in educational media and experimental educational psychology from Temple University, Dr. Jonassen has taught at the Pennsylvania State University, University of Colorado, the University of Twente in the Netherlands, the University of North Carolina at Greensboro, and Syracuse University. He has published 28 books and numerous articles, papers, and reports on text design, task analysis, instructional design, computer-based learning, hypermedia, constructivist learning, cognitive tools, and technology in learning. He has consulted with businesses, universities, public schools, and other institutions around the world. His current research focuses on constructing design models and environments for problem solving.

Dr. Myunghee Kang, professor of Educational Technology at Ewha Womans University in Korea, teaches *e-Learning Design and Development Strategies, Knowledge Construction, Learning Community and Virtual Communications and Emerging Technologies in Education*. Her recent research interest is to find an optimum learning solution for adult learners by investigating c-Learning, e-Learning, m-Learning, learning community and knowledge constructing & managing issues. Her numerous research papers have been published in *Educational Technology Research Journal, Training Research Journal* in Korea and *Educational Technology and eLearning Journal* in U.S.

Dr. Koh Thiam Seng is an Associate Professor in Science Education at the National Institute of Education. He has research interests in the use of ICT in science education. He is currently on secondment to the Singapore Ministry of Education as Director of Educational Technology.

Dr. Lee Kar Tin is Principal Lecturer and Head, Department of Information and Applied Technology at the Hong Kong Institute of Education in Hong Kong. Throughout her career, she has provided leadership for numerous university and government funded projects in ICT innovation. Currently she is involved in research and development projects in both the primary and secondary sectors which focus on designing, implementing and evaluating online learning environments. Along with her interest in researching teaching and learning online she continues to actively explore factors influencing teacher's use of emerging technologies in various learning environments. She strongly believes in introducing new educational options to teachers in the field in order to strengthen and transform current educational practice. In January 2006 she will join the Queensland University of Technology, Australia as Professor and Head, School of Mathematics, Science and Technology Education.

Professor Susan E. Metros (M.F.A., 1976, Michigan State University) is Deputy Chief Information Officer and Executive Director for e-Learning at The Ohio State University. She also holds the faculty appointment of Professor of Design Technology. She has more than twenty-five years of university level teaching experience and almost ten years experience in information technology administration. As Deputy CIO, she is responsible for leading the academic community in appropriately using technology-enhanced teaching and learning, both on campus and at a distance. In her role as educator and designer, she teaches within the visual communication curriculum and has served as principal designer on several international award winning interactive multimedia and Web-based projects. She is also active on numerous international and national committees and task forces and has published and presented widely on the role of eLearning in transforming education to be sharable, engaging, interactive and learner-centered.

Prof. dr. Jef Moonen is emeritus professor in the Faculty of Behavioural Sciences at the University of Twente in The Netherlands where he participates in the research team "Technology for Strategy, Learning and Change". Prior to his retirement he served as department chair and dean of the faculty. His current research includes studying digital portfolios as tools for the contribution-oriented pedagogy. In addition, he continues his long-standing research on return on investment of computer-supported learning.

Reinhard Oppermann received his diploma in psychology in 1973 and his Ph.D. in 1975 at the University of Bonn. In 1979, he joined the GMD German National Research Center for Information Technology, since summer 2001 merged with the Fraunhofer Gesellschaft. Currently he is head of the research department Information in Context in the Institute for Applied Information Technology. In 1993, he was appointed to an honorary professorship at the University of Koblenz now working at the Institute for Computational Visualistics. His main research interests include participatory system development, human factors of human-computer interaction, ergonomic evaluation methodology, adaptive and adaptable information systems and user modelling, contextualized learning, and nomadic information systems.

Alan Pritchard is a researcher and lecturer, and member of the Centre for New Technologies Research and Education (CeNTRE), at the Warwick Institute of Education, University of Warwick, UK where he teaches a range of courses for Undergraduate and Postgraduate trainee teachers, as well as teaching on the Institute's higher degree and in-service programmes. Previously he has been a teacher with responsibility for Mathematics, Science, Design and Technology and Information and Communications Technology (ICT), an Advisory Teacher for ICT, and Deputy Head of a Primary School. He has undertaken research and published articles in the academic press on children's learning, with particular reference to the use of new technology, design and technology, initial teacher education, and the links between ICT and other subjects. He writes widely for professional journals and magazines for teachers. His books include *Education.com: an introduction to learning, teaching and ICT* (2000). *Using ICT in Primary Mathematics Teaching* (2002) *Learning on the Net* (2004) and most recently *Ways of Learning* (2005).

Dr. Geoff Romeo a senior lecturer in the Faculty of Education at Monash University, Australia. He has been with the Faculty since 1991. Prior to this he was a teacher with the Education Department of Victoria. In 1989 he was an International Teaching Fellow and taught for 12 months at Galveston Elementary School in Arizona, USA. His research interests include the use of ICT in education, at all levels, to improve teaching and learning, online teaching and learning, the development of primary and middle school curriculum, action research and education in general. Dr Romeo is the immediate past president of ICT in Education Victoria, and a past member of the Australian Council for Computers in Education and the Standards Council of the Teaching Profession. Dr Romeo is active in delivering and organizing Professional Development for schools, organizations and teachers, and has presented at conferences, seminars and workshops in Australia, the United Kingdom, USA, Denmark and Chile.

Marlene Scardamalia is the Presidents' Chair in Education & Knowledge Technologies at OISE/University of Toronto and the Director of the Institute for Knowledge Innovation and Technology, IKIT—a worldwide network of innovators working to advance the frontiers of knowledge building in various sectors. “Knowledge building,” a term now widely used in education and knowledge management, originated with the CSILE/Knowledge Building project. Marlene is the inventor of CSILE (Computer Supported Intentional Learning Environments), which was the first networked knowledge building environment for education. The second generation version of this technology, Knowledge Forum®, is in use in 19 countries, in education, health, business, and professional organizations. Knowledge building theories, models, practices and technologies have been developed in partnership with Carl Bereiter and team members, and form the basis of two recent awards: (1) The Canadian Foundation for Innovation and (2) the INE Collaborative Research Initiative awards. From 1996 till 2002, Marlene has been the K-12 theme leader for Canada's TeleLearning Network of Centres of Excellence. Her work has led to several honours and awards, including an Ontario Psychological Foundation Contribution to Knowledge award, a fellowship at the Center for Advanced Study in the Behavioral Sciences, election to the U. S. National Academy of Education (the second Canadian so honoured) and appointment to the Presidents' Chair in Education and Knowledge Technologies for the Ontario Institute for Studies in Education of the University of Toronto. She has done research and published in the areas of cognitive development, psychology of writing, intentional learning, the nature of expertise, and educational uses of computers. She also headed a project on "Cognitive Bases of Educational Reform," out of which grew the "Schools for Thought" program, notable for its synthesis of major educational initiatives.

Marcus Specht received his Diploma in Psychology in 1995 and his Ph.D. from the University of Trier in 1998 on adaptive learning technology. Marcus Specht currently works as a researcher at the GMD German National Research Center for Information Technology, since summer 2001 merged with the Fraunhofer Gesellschaft. He has rich experience in intelligent tutoring systems and the integration of ITS and Web-based tutoring from former projects in the field of adaptive hypermedia and ITS (ELM-ART, InterBook, AST). His main research interests are adaptive learning and training systems, knowledge management, contextualized computing, and intelligent interfaces.

Myint Swe Khine is Associate Professor at the National Institute of Education, Nanyang Technological University, Singapore, where he teaches undergraduate and postgraduate courses in the area of learning sciences and technologies. His research interests include application of emerging

technologies in teaching and learning and technology-rich learning environments. He is an Editorial Board Member of the *Educational Media International*.

Johannes Strobel is Assistant Professor in the Educational Technology programme at Concordia University, Montreal, Canada USA. After studying philosophy, religious studies, psychology, and information science in Germany, he finished his PhD (2004) at the School of Information Science and Learning Technologies at the University of Missouri-Columbia. He is focusing in his research and teaching on the intersection between learning and technology. He is interested in the use of computers as cognitive tools including concept mapping, expert systems, system modeling, and hypertext systems. Recent projects include research on teachers' use of technology, case-based reasoning, ill-structured problem solving, every-day learning, students' individual setup like epistemological beliefs, domain specific reasoning, historical reasoning and conceptual change/formation.

Dr. Tan Seng Chee completed his Ph.D. in Instructional Systems from the Pennsylvania State University in 2000. He is currently an academic staff in the Learning Sciences and Technologies academic group, National Institute of Education, Singapore. He is holding a concurrent appointment as an Assistant Director, ETD/MOE, leading the Research & Development team. His research interests include using computers as cognitive tools and Computer-Supported Collaborative Learning. As a new scholar in educational technology, he has actively contributed to the research and publications in this field. For instance, he has recently completed a \$260,000 Ministry granted research project on “Fostering scientific inquiry through Computer-Supported Collaborative Learning” and has contributed 3 books, 9 book chapters, 20 refereed journal papers, 11 refereed papers in conference proceedings, and 15 other publications to date. He also contributed actively as a professional member in the field of ICT research, serving in the editorial board for the journals *Technology Source* (2001-2003), *Innovate* (since 2004), and the AACE/SITE journals (since 2004). He is currently a professional member of the Educational Research Association (Singapore) and Association for the Advancement of Computers in Education (AACE).

Dr. Minjuan Wang is assistant professor of Educational Technology at San Diego State University. She teaches *Methods of Inquiry*, *Instructional Design*, *Technologies for Course Delivery*, and *Technologies for Teaching*. Her research specialties focus on the sociocultural aspects of online learning (e.g., learning communities, gender and cultural differences in online collaboration) and technological interventions in language and literacy education. She has peer-reviewed articles published in *Educational Media International*, *TechTrend*, and the *International Journal of Educational*

Technology. She has also published several book chapters on engagement in online problem solving, informal learning via the Internet, and effective learning in multicultural and multilingual classrooms. Her paper on *Gender, discourse style, and equal participation in online learning* won an outstanding paper award from E-Learn 2002: world conference on E-learning in corporate, government, healthcare, and higher education.

Allan H.K. Yuen, (Ph.D.) is Head of the Division of Information and Technology Studies, Faculty of Education, University of Hong Kong, Pokfulam Road, Hong Kong (e-mail: hkyuen@hkucc.hku.hk), and Deputy Director of the Centre for Information Technology in Education (CITE) at the University of Hong Kong since its establishment in 1998. He is the vice president of the Hong Kong Association for Educational Communications and Technology. Dr. Yuen has led a number of research and development projects on information technology in education. His research interests include computer supported collaborative learning, information technology leadership and management in education, computer studies education, and teacher education.

INDEX

- abstract conceptualization (AC) 230
- academic performance 127, 131, 132, 134, 135, 141, 143, 228
- achievement goals 226, 228, 253
- acquisition model 52, 53
- active experimentation (AE) 230
- activist 230
- activity design 240
- activity theory viii, 14
- American Association for the Advancement of Science 38
- analysis of variance (ANOVA) 141
- anchored instruction 44, 45
- annotation facilities 75, 80, 81
- assessment xv, 30, 31, 49, 50, 58,, 59, 61-64, 77, 92, 97, 99, 119, 139, 154, 155, 159, 160, 164-166, 171-173, 178, 179, 203, 204, 211, 212, 226-230, 239, 243, 247, 253, 255, 256-268, 270, 271
 - methods 253
 - options 269
 - strategies 236, 253, 255
- assessment-centered environments 153
- attitudes 34, 103, 130, 153, 164, 166, 171, 172, 179, 113, 247
 - development 34
- authentic experience 29
- authentic learning 33, 38, 73, 107, 187
 - environments 39-41
 - conditions for 40
- best-use scenarios 255, 256
- black box models 22
- capitalism vii
- central experts 73
- Christianity vii
- classical Greece vii
- classroom learning 44, 233
- clinical reasoning strategies 36
- clinically useful knowledge 36
- CMC 128, 131
 - tools 128, 144, 245
- cognition 8, 24, 32, 34, 44, 184, 187, 208, 231
- cognitive strategies 34
- cognitive structures 16, 17
- cognitive styles 227, 230
- cognitive tools 1, 43
- collaboration xv, 3, 6, 29, 39-45, 50, 60, 64, 76, 95, 97, 130, 137, 143, 144, 159, 166, 171-173, 177, 229, 240, 244, 245, 267
- collaborative learning vii, x, xiv, 91, 108, 133, 137, 144, 154, 159, 165, 171, 172, 207, 208, 237, 238, 240, 243, 244, 253
- communal discussion (CD) 138, 139, 142-144
- communication 42, 45, 52, 55, 62, 63, 76, 119, 120, 123, 127, 129-131, 137, 144, 159, 215, 226, 230, 234, 237, 241-246, 253, 262, 268
 - facilities 75, 83
 - functionalities 61
 - norms 59
 - technologies xv, 108, 127, 149, 150, 155, 158, 162, 225
 - - role in education 155
 - skills 44, 253
 - tools 43, 44, 237, 240
- community
 - building 42, 131, 144, 235, 236, 244-246, 253
 - feeling of belonging to 233
 - -centered environments 153-155, 164, 165, 172
- computer supported learning 262
- computer-aided learning (CAL) 258
- computer-based learning (CBL) 59, 258
- computer-mediated communication 127
 - tools 44, 128
- computer-programming skills 259
- computers ix, x, xiv, 85, 107, 149, 150, 155, 157, 167, 205, 209, 210
 - in education perspective 155
- Computer-Supported Intentional Learning Environments 35

- computer-supported collaborative learning (CSCL) xiv, 91, 95
- concept map 17, 23, 43, 112-114, 192
- conceptual change 1, 5, 24, 152
- concrete experiences (CE) 230
- consistent visual metaphors 116
- constructivism 1, 44, 52, 55, 91, 109, 177, 185, 234
- constructivist epistemology 91, 104
- constructivist learning 78, 91, 92, 104, 184
 - activities 38
 - environment 43, 44
 - tools 45
- constructivist learning theories 109, 183
- contemporary educational psychology 263
- context facilities 75
- contributing student 49, 54, 55, 58
 - approach 50, 55, 57
 - - in practice 56
 - - pedagogy 50, 54
- contribution-oriented
 - activities 53, 54, 59-61, 65
 - pedagogy 61-63, 65
- conventional learning 130, 138, 139, 142, 144
- conversation as learning activity 267
- coursework 109, 257
- CoVis (Collaborative Visualization) project 33
- curriculum innovation 127
- customized engagements 225, 237
- customized learner engagement, cybergogy 237
- cutting-edge technology 182
- cybergogy xv, 225, 226, 237
 - for customized learner engagement 237
 - for engaged learning 226, 231, 238, 247
- cycle diagram 192

- data analysis 134, 135
- data collection 92, 127, 134
- deductive simulations 1, 21

- Descartes, R. vii
- design intentions 108, 109, 123
- Dewey, J. viii, 35, 152
- dialogue xvi, 32, 36, 44, 60, 116, 177, 185, 225, 239, 270
- digital age 154, 159, 269
- disciplinary engagement 38
- domain specific knowledge 34
- domain specific problem solving 43

- education in the knowledge age xiv, 91, 93
- educational process, problems 36
- educational technology xiii, 92, 150, 157, 160
 - futures 173
 - - scenario planning 160
- effective collaboration 130
- effective collaborators 36
- effective conceptual model 115
- effective learning 128, 151, 153, 154, 164, 171, 177-183, 188, 190, 197, 198, 207, 231, 256, 262, 269
 - designing 153
 - environments 150, 153, 155, 160, 173
 - in the electronic age xiv, 177
- effective mapping 115
- effective self-directed learning strategies 36
- e-learner 156
- e-learning xiv, 69, 70, 79, 107-110, 113, 114, 121-123
- electronic age xiv, 177
- electronic working tools 70
- embedded information cases 39
- emotional cues 226, 241, 253
- emotion-learning 235
- emotive factors 226, 231, 247
- engaged learning
 - critical factors 253
 - environments, implications 39
 - framework xiv, 29, 40, 41, 43, 45
 - - proposed 40
 - indicators 30-32, 253
 - model 234, 247
 - technologies x, 43, 44

- with emerging technology vii, xv, 158, 159
- engagement 107
 - with artifacts viii
 - with learning viii, ix
 - with technology ix
 - with the world vii
- engaging instruction, designing 237
- engaging interface, creation 110
- episodic memory 82
- epistemological beliefs 24
- epistemological knowledge 34
- e-teacher 156
- examinations 207, 211, 257, 259, 271
 - in certain subject areas 258
- EXIT model 190, 191
- expert systems 1, 9, 12, 13, 19, 20, 22
- experts 22, 23, 32, 36, 38-43, 45, 62, 73, 74, 81, 83, 112, 118, 151, 156
- exploration 150, 168, 179, 182, 183, 192, 214, 217, 227, 231

- facilitators 35, 40, 41, 92, 215
 - role 37
- feedback 21, 45, 51, 55, 57-64, 77, 97, 102, 115, 117, 128, 152, 154, 157
 - systems thinking 14
- formative assessment 160, 165, 166, 255, 257, 263, 269-271

- Generation X 238
- Gestalt principle 122
- globalised community 205
- graphical user interface (GUI) 107, 108, 114, 123
 - design 119
 - interactions 114
- group cognition viii

- health sciences 255
- Hegel, G.W.F. viii
- Heidegger, M. vii, viii
- Heidegger's critique of western assumptions vii
- Hong Kong, special administrative region (SAR) 205
- human-computer
 - interaction 109
 - interface designers 109

- information and communication
 - technology (ICT) xv, 127, 128, 144, 149, 150, 155, 160, 162, 198, 203-210, 225
 - -enhanced classrooms 205
 - -enriched learner-centred environments xv, 203-206, 211, 213, 215-217, 219
 - -enriched classroom 216
 - -enriched learning 203
 - in Hong Kong's school education 205
 - -intensive community 205, 208
 - tools 144, 213, 215, 219
- idea map 192
- inductive simulation models 1, 21
- information and communication
 - technologies in education (ICTE) 149
- information design 110
- information handling process loop 193
- information technology (IT) xiv, 69, 74, 78, 155, 181, 205, 206, 255, 257
 - role in education 155, 204
- inquiry vii, 38
- Inquiry Learning Forum (ILF) 131
- inquiry-based learning 138, 143
 - literature 50, 271
- instruction 2, 29, 31, 49, 50, 53, 65, 69-71, 75, 76, 79, 81, 104, 108, 128, 130, 132, 144, 150, 162, 168, 179, 189, 210, 229, 230, 237, 239, 240
 - first principles of 50
- instructional design 118, 217, 225, 238, 259
 - literature 237
- instructional principles 50
- integrated online assessment
 - guidelines for 261
 - learning from lectures 265
- interaction design 114, 116
- internet 53, 107, 128, 131, 136, 150, 158, 162, 167, 177, 181, 190, 197, 198, 219, 236, 246

- interpersonal connections 232, 233, 244
- K-12 learners 93
- K-12 schools 33, 97, 225
- in Singapore 97
- K-12 teachers 92, 98, 279
- Keller's ARCS model 233, 239
- knowledge age xiv, 91, 93, 104, 128, 129, 143
- knowledge building viii, x, xiv, xvi, 49, 93-95, 97-104, 127, 130-134, 136, 137
- classrooms 91
 - communities 2, 95, 99, 103, 104, 130
 - discourse 95, 129-131
 - engagement in 100
 - environment 95
 - in transition in Singapore schools 97
 - process 134, 137
- knowledge construction 24, 45, 97, 130, 132, 143, 144, 160, 166, 226, 227, 238, 253
- knowledge creation 50, 91, 93, 95, 130
- knowledge forum (KF) 91, 127, 132
- Knowledge Forum Client version 3.4. 133
- knowledge-centered environments 153, 155, 164, 171
- knowledge-driven community 205
- laboratory practicals, assessments in 259
- leadership 15, 54, 203, 216, 217
- learner
- as actor 116
 - -centered environments 153, 164, 171
 - engagement xv, 50, 51, 107, 108, 110, 122, 225, 232, 233, 237, 264, 269
 - - framework for creation of 225
 - models 69, 77
 - teacher role 116
- learning
- activity xv, 34, 35, 38, 44, 49, 50, 53-56, 58, 60, 78, 79, 97, 113, 130, 187, 203, 206, 207, 214, 219, 226, 227, 229, 253, 256, 258, 260, 262-265, 267, 271
 - - conversation as 267
 - and consultation 69
 - and relearning 69
 - approaches to 144, 152, 178, 186, 188, 189, 258, 260, 261, 263
 - atmosphere 234, 247
 - - feeling of 226, 232, 234, 247, 253
 - authenticity in 33
 - community 31, 129
 - - building 244
 - context 31, 56, 69, 92, 99, 108, 109, 210, 226
 - culture 127
 - design 49, 59, 227, 255, 262
 - motivation 36, 233
 - objectives 110, 121, 156, 162, 167, 170, 183, 189, 228, 233, 237, 259, 262, 270
 - on demand 69
 - on the job 71
 - process xiv, 30, 36, 37, 40, 50, 55, 69-71, 75, 79, 80, 92, 118, 127, 156, 172, 177, 214, 215, 225, 226, 228, 231-238, 240, 241, 246, 247, 253
 - - feelings emerging from 234
 - - finding out 36
 - psychology of 262
 - role of assessment in 255, 256
 - styles 107, 154, 165, 172, 188, 206, 226, 230
 - support 69, 72, 73, 75-77, 80, 81, 86, 208
 - - contextualization 76
 - - technology xiv, 79
 - - tools, components 85
 - with technology 149, 155, 159, 161
- learning-content management systems (LCMSs) 65
- LISTEN 78, 79
- local experts 73, 74
- Marx, K. viii
- meaningful learning xiii, 1, 2, 23-25, 43, 54, 104, 158, 160
- characteristics 3

- modeling 1
- meaningful problems 39
- mental models 1, 4, 6-9, 22-25, 181, 183
 - individual 4
 - collaborative group 6
 - modeling 7
- message design 239
- metacognition 24, 35, 42, 177, 187, 188
 - literature of 35
- metacognitive activities 35, 189
- metacognitive knowledge 34, 187, 188
- metacognitive skill 34, 37, 157, 255
- metacognitive strategies 29, 39
- mind map 192
- mindtools 1, 43, 45, 155, 157
- model construction 7-9, 23, 24, 243
- model-based environments 4
- model-based learning systems 9, 20, 25
- model-based reasoning 1
- model-based software 25
- modeling xiii, 1, 3, 7, 9-11, 15, 16, 18, 20, 23-25, 37, 112, 120, 234, 238, 239
 - domain knowledge 7, 9, 18, 25
 - problems 7, 10, 25
 - semantic structure 7, 16, 18, 25
 - systems 1, 7, 13, 15, 25, 269
 - thinking 7, 18, 25
 - tools 1, 8-13, 18, 21, 23, 24, 43
- Model It 15, 21
- monitoring 19, 34, 35, 39-43, 45, 55, 62, 162, 188, 190, 227, 258, 267
 - and planning 39
- motivation viii, ix, xii, 33, 34, 36, 49, 50, 77, 100, 109, 110, 152, 153, 164, 166, 171, 172, 178, 180-182, 198, 207, 228, 232, 233, 236, 246, 255, 256, 262, 266
- multimedia 58, 83, 86, 107, 111, 157, 158, 161, 163, 166, 169, 183, 261, 262, 265, 269
- multiple choice 58, 257, 259, 265

- NASA ix
- National Research Council 34, 38
- NCET process 193

- network technologies 50, 156-158
- North Central Regional Education Laboratory (NCREL) 92, 158
 - model of engaged learning 95, 98

- online assessment xv, 255, 256
 - continuous 255, 258-261, 264-267, 270, 271
 - practice xv, 255
 - - 1994-2004 256, 257
- online communication 226, 232, 241, 244, 245, 262
 - facilitating 241
- online community 233, 236, 240, 244-246
- online discourse xiv, 127, 129, 131, 132, 135, 142-144
- online facilitation 225
- online help support 72
- online learning xv, 225, 226, 231, 233, 236, 240-242, 247, 255, 262, 266, 270
 - communities 128, 143, 233
 - environment 226, 238, 242
- online multi-choice assessments 255, 256
- online participation 121, 134, 137, 139, 234
 - patterns 139, 141
- online presence 225
- ownership 24, 40-43, 45, 91, 94, 100, 154, 165, 166, 170-173, 210, 238, 253

- participation model 52, 53
- PBL
 - active learning strategies 38
 - metacognitive learning strategies 38
- pedagogical models 49, 50, 52, 54, 265, 266
- pedagogy 35, 49, 54, 56, 61-65, 98, 99, 101, 127, 130, 143, 144, 155, 173, 205, 206, 260, 265
- perceived learning 131, 235
- personal attributes 226, 235, 236, 253
- personal digital communicators and assistants (PDCA) 167

- Piaget, J. 152, 183-185
 planning xiv, 34, 39, 44, 61, 63, 113,
 149, 159-161, 186, 198, 211, 212,
 227
 Plato vii
 postmodernism 209, 210
 PowerSim 15, 21
 practice-oriented tools 34
 pragmatism 173
 pragmatist 230
 - learning style 230
 - viewpoint vii
 presentation 43, 53, 76, 78, 79, 85, 118,
 119, 181-183, 234, 265-267
 primary education 127
 prior knowledge 72, 177, 184, 185,
 190, 191, 196, 198, 226-228, 247,
 262, 266, 271
 prior knowledge/experience 228, 253
 problem solving 1, 6, 11, 19, 36, 38-45,
 58, 74, 75, 81, 86, 128, 135, 151,
 154, 165, 171, 173, 208, 239, 261
 - activities 58, 259, 264
 - dialogue 36
 - medical 38
 - strategies 154, 165, 171, 173, 259
 - together working of small groups 36
 problem-based learning (PBL) xiii, 29,
 30, 35-40, 229
 - fundamental approach 36
 - in Medical school 36
 - real-world case studies 36
 professional development 91, 98, 113,
 206, 211
 project space 114, 122, 156
 - definition 110
 project-based learning 36, 92, 93, 132
 project-based science (PBS) 38, 39
 psychology of learning 262
- QUADS grid 192
- reflection 3, 35, 42, 45, 53, 60, 62, 64,
 65, 69, 80, 102, 103, 130, 134, 153,
 157, 164, 166, 171-173, 182, 183,
 189, 227, 268
 - in action 69, 80
- reflective observation (RO) 230
 reflector 230
 - evidence 181
 research-based practice 268
 revised curriculum activities 33
- schemas 11, 17, 112, 183-185, 191
 school cultural change 203
 school-based curriculum 211, 212
 school-based investigation 196
 science education 127
 science knowledge 135, 138, 139, 143
 Scientific and Mathematical Arenas for
 Refining Thinking (SMART) 35
 scientific knowledge 33
 - building 132, 134, 136, 137
 scientific processes in the classroom 34
 Sci-Fi perspective 155
 Second International Information
 Technology in Education Study 214
 self-assessment 257
 - of project work 259
 self-competence 232
 self-confidence 226, 232, 233
 self-efficacy 219, 232
 - beliefs 34, 35, 39
 self-regulated learning 29, 40, 225, 227,
 238, 253
 - literature of 35
 self-regulation 29, 34, 153, 166, 172
 - social dimension of 34
 self-regulatory actions 29
 self-regulatory behaviors 34
 self-regulatory learning 29, 30
 self-regulatory processes 42
 semantic memory 82
 semantic modeling tools 1, 9, 23
 situated annotation authoring 80
 situated e-learning xiv, 69, 70
 - methods 69
 situated learning viii, 69, 71, 79, 83,
 177, 186, 187
 Smartcard 162, 163, 173
 social constructivism 44, 52, 55, 185,
 234
 social constructivist 185
 - learning activities 38

- philosophy 104
- tools 45
- social context 34, 39, 76, 83, 236
- individuals acting in 34
- social discourse 34
- social factors 226, 231, 235, 247
- social interaction 34, 70, 83, 185, 208, 236, 245
- social sciences 13, 209, 255, 257
- social software 240, 245, 246
- usage 245
- spider web 192
- staging activities 39
- Stanford Research Institute (SRI) 92
- Stella 13-15, 20, 21
- student
 - engagement 33
 - knowledge 34
 - participation 129-132, 135, 139, 140, 144
 - perceptions 127, 131, 132, 134, 135, 138, 139, 142, 144, 253
 - - change 142
 - with cultural background 246
 - with linguistic background 246
- student-centred learning xiii, 203, 209, 213, 217, 219, 255-257, 260, 267
- supportive tools 39
- sustained voluntary attention 263, 270
- systems
 - modeling 1
 - tools 9, 13, 21, 23
- teaching science 128, 136
- basis xiv, 127, 135, 143
- teaching strategies 203, 212, 258, 263
- techniques xiv, 34, 39, 42, 116, 121, 151, 160, 171, 247, 256-260
- technology
 - in education 149, 157, 158, 160, 173, 208, 259
 - need to design x
 - roles of 55, 56, 61, 155, 160
- theorist 6, 152, 187, 198, 230
- tools x, xvi, 1-3, 8, 10-15, 17, 18, 20, 21, 23-25, 32, 34, 35, 38, 40-45, 49, 50, 57, 62, 63, 65, 70, 71, 75, 79, 80, 83, 85, 86, 108, 109, 123, 128, 144, 156-159, 173, 182, 204, 213, 215, 218, 219, 232, 237, 239-241, 245, 246, 267
- training on the job 71
- transformation 37, 39, 182, 183, 227
- transformative assessment 97
- understanding vii, viii, 3, 177
- venn diagram 192
- VenSim 15, 21
- visibility 114, 243
- visual conventions 116
- Vygotsky, L.S. vii, viii, 152, 177, 185, 186, 234
- Vygotsky's socio-cultural psychology vii
- Vygotsky's zone of proximal development viii
- web environments 50, 56, 59,, 61, 62
- learning resources 49