This book follows from the International Conference on Intelligent Tutoring Systems (ITS-88) held June 1–3, 1988, in Montréal, Canada. It contains a selection from the best papers of ITS-88. The authors who have contributed have improved and extended the paper they presented at the conference.

The goal of the conference was to bring together specialists from the fields of artificial intelligence and education, two strong and convergent domains of research which need, more and more, collaborative works. Both disciplines tackle fundamental and ambitious goals and the expertise developed by the two research communities is proving to be complementary and fundamental in contributing to the study of a very complex subject: mental behavior of the human being.

The conference was launched to encourage a close cooperation between the two research communities and to focus on high-level concepts and ideas in order to serve as a strong reference basis for future research. We were also curious to see the state of development of ITS in the world. The response from the international community largely met our expectations: We received 142 communications from 16 countries. To insure a high level at the conference a strong international committee (from eight countries) was set up by Marlene Jones (Alberta Research Council) and Gregor Bochmann (University of Montréal). All contributed papers were assigned to several members of the Program Committee for evaluation. In most of the cases, the papers were reviewed by five referees. In addition, a large number of high-level speakers have been invited to present the State of the Art in different research areas: Jacques Arsac, Patrick Suppes, John Seely Brown, Philip Winne, Elliot Soloway, John Self, Jeffrey Bonar, Beverly Woolf, and Masoud Yazdani. Two panels conducted by Stuart Macmillan and Gordon McCalla including Albert Corbett, Stellan Ohlsson, Elliot Soloway, Patrick Suppes, Beverly Woolf, Marlene Jones, William Clancey, Gerhard Fisher, and David Litten led to stimulating discussions. The success of the conference was greatly due to the contributions of the speakers and the panelists.

Several scientific organizations gave us their support: the Canadian Society for Computational Studies of Intelligence (CSCSI), the Association française pour la cybernétique économique et technique (AFCET), the Association for Computing Machinery (ACM) and its special interest groups SIGART and SIG-CUE, the Inter-American Organization for Higher Education, and the British Computer Society (BCS).

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The evolution from Computer-Aided Instruction (CAI) to Intelligent Computer Aided Instruction (ICAI) was the first step by which Education and Artificial Intelligence communities began to look at each other’s work. The impetus for contributions from artificial intelligence came from the studies on knowledge acquisition, knowledge communication, knowledge models, knowledge misunderstanding, expert knowledge, and so on. They address fundamental issues related to the wide and complex domain of education of the human being. We can think of the evolution towards Intelligent Tutoring Systems (ITS) step beyond ICAI, leading to new classes of problems and approaches and where learning is at least as important as teaching. ITS involves artificial intelligence concepts including knowledge representation and communication, problem solving approaches, dynamic student modeling, human cognition, intelligent user interfaces, intelligent help systems, use of strategies, and so on.

As work progresses in these areas, various research has uncovered complex problems requiring fundamental studies. We do need to capture more knowledge about several fundamental components of ITS and several questions arise: What is the influence of the learning environment in an ITS? What are the tools that could improve the learning process? What are the means to obtain an adequate model of the student? How could we advise and help the student in an intelligent way? What strategies should an intelligent learning system employ? Finally, what have we reached in AI and Education and what is the magnitude the difficulties in the present ITS research?

This book examines all of the above-mentioned questions. Thirteen chapters address several fundamental aspects of ITS: the learning environment in the student is placed, the student modeling problem, the planification of content of instruction, the teaching and learning strategies, and finally we talk about the future of the ITS project.

LEARNING ENVIRONMENT

Tak-Wai Chan and Arthur Baskin (Chapter 1) propose intelligent tutoring systems of a new breed—the Learning Companion Systems (LCS). In the learning environment of such a system, there are three agents involved, namely, human student, the computer learning-companion, and the computer teacher. The role of the computer learning-companion is to act as a learning companion for the student. To this end the companion performs the learning task at about the same level as the student, and both the student and the companion exchange ideas while being presented the same material by the teacher. The goal of