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Preface

Researchers and educational software developers have talked about building authoring tools for intelligent tutoring systems (ITSs), adaptive and knowledge-based instructional systems, and other forms of advanced-technology learning environments (ATLEs) ever since these forms of educational software were introduced in the 1970s. The technical complexity and high development costs of these systems contrasts sharply with the common picture of education as a "home grown" activity performed by individual teachers and trainers who craft lessons tailored for each situation. There have been two primary reasons to create authoring tools for ATLEs: to reduce development cost, and to allow practicing educators to become more involved in their creation. The goal of creating usable authoring tools dovetails with the recent trend toward interoperability and reusability among these systems.

We use the phrase "advanced-technology learning environment" to refer to educational software on the leading edge of practice and research. These systems go beyond traditional computer-based instruction or educational simulations by providing one or more of the following benefits:

- Providing rich, or even "immersive" interfaces so that students can "learn by doing" in realistic and meaningful contexts.
- Dynamically adapting the interface or content to the student's goals, skill level, or learning style.
- Providing expert hints, explanations, or problem solving guidance.
- Allowing "mixed-initiative" tutorial interactions, where students can ask questions and have more control over their learning.
- Incorporating instructional models that base interactions on proven educational theories, or that allow the interactions to more closely approach the benefits of individualized instruction by a competent pedagogue.

The ATLE authoring tools field has advanced significantly since the first conference workshop on the subject in 1995. Since then there have been a number of international workshops dealing with the subject (including workshops at the AI in Education international conferences in 1995, 1997, 1999; the Intelligent Tutoring Systems international conference in 1996; and the American Association of Artificial Intelligence Fall Symposium in 1997). In addition there have been several special issues of research journals on this topic (including the International Journal of AI in Education Vol. 5 No. 3, 1998, and Vol. 10 No. 1, 1999; J. of the Learning Sciences Vol. 7 No. 1 1995; and J. of Instructional Science Vol. 26 Nos. 3-4 1998). This volume, which is the first book on the subject, contains chapters providing updated reports on all of these workshops and publications. It provides a comprehensive picture of the state of the art in ATLE authoring systems, with representative chapters from almost every major researcher in the field. Contributions to this volume come from an international cadre of researchers from
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Canada, the Netherlands, Spain, the United Kingdom, and the United States. Significant work in authoring tools is ongoing in several other countries as well (including Japan and Germany).

This volume should appeal to many readers interested in the use and/or development of ATLEs. To quote from the overview chapter by Murray:

"I imagine two types of readers. First are academic or industry personnel in the field of instructional software research or development. They might ask the question "what methods and designs have been used, and how successful have they been?" in their efforts to build the next generation of systems. The second type of reader is the user, developer, or purchaser of instructional software (advanced, intelligent, or otherwise) who might ask the question: "what is really available, or soon to be available, to make ITS authoring cost effective?"

The reader will note the word "toward" in the title of the volume. The field is still very much in a formative stage. The systems described in the 17 chapters to follow are predominantly R&D efforts or local success stories. That is, few have been used to produce numerous tutoring systems nor have they been used by people not closely associated with a research team (with some notable exceptions, as discussed in the Overview chapter). This state of affairs with ATLE authoring tools reflects the state of ATLEs in general, which have shown some successes but have been slow to enter the main-stream commercial education and training markets. However, despite its formative nature, the importance of making ATLEs more cost effective and authorable warrants the publication of a book such as this that describes the state of the art. The design issues are complex and the implemented solutions are quite diverse. Much progress has been made in articulating the issues and fleshing out solutions, and a number of projects have completed empirical studies demonstrating usability and cost-effectiveness. A few of the chapters describe projects that were completed some years ago, and these were included because their research results and design innovations still represent the state of the art on certain issues.

The chapters in this volume are organized based on an analysis of authoring systems given in the Overview chapter which distinguishes authoring tools according to the following categories: Authoring Tutors for Device and Process Simulations, Authoring Tutors that Encode Human Expertise, Authoring Tutors that Include Instructional Strategies, and Special Purpose Authoring Tools. Some readers may wish to read the final Chapter first, an overview of ITS authoring tools, and authoring tools issues.

Chapter 1 describes SimQuest, an authoring tool for creating simulation-based learning environments that focus on science concepts and principles. Chapter 2 describes XAIDA, an authoring tool that has been used to develop simple simulations that can address a variety of knowledge types, including facts, concepts, procedures, and principles. Chapter 3 describes RIDES, a tool for authoring tutorials bases on sophisticated device simulations. Chapter 4 describes Demonstrate, a prototype authoring tool that explores authoring domain content by having authors providing examples and demonstrations, and then intelligently creating
Related workshops and symposia


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Journal Special Issues

- Journal of the Learning Sciences, Special Issue on authoring tools for interactive learning environments, Vol. 7 No. 1 1998, guest editors Benjamin Bell and Carol Redfield.
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