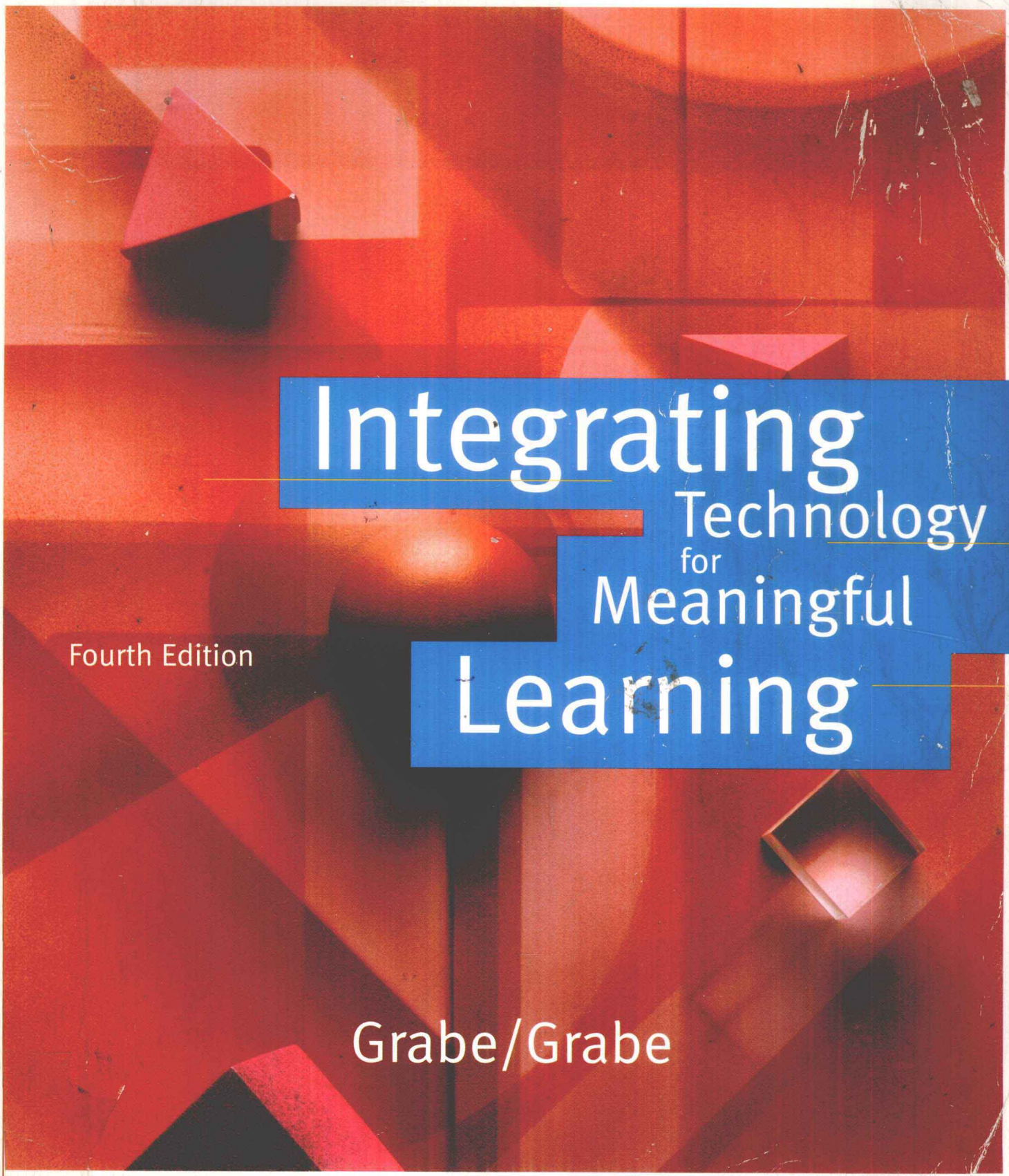
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Fourth Edition
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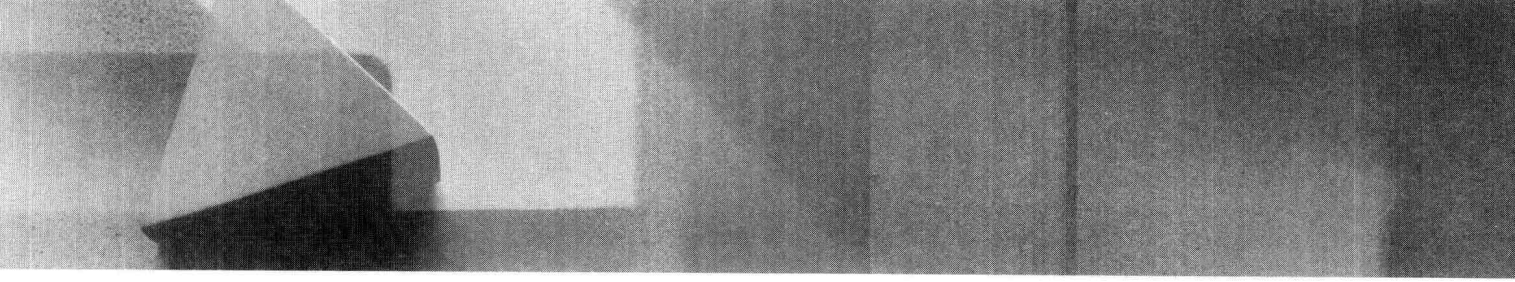

Integrating Technology for Meaningful Learning

FOURTH EDITION

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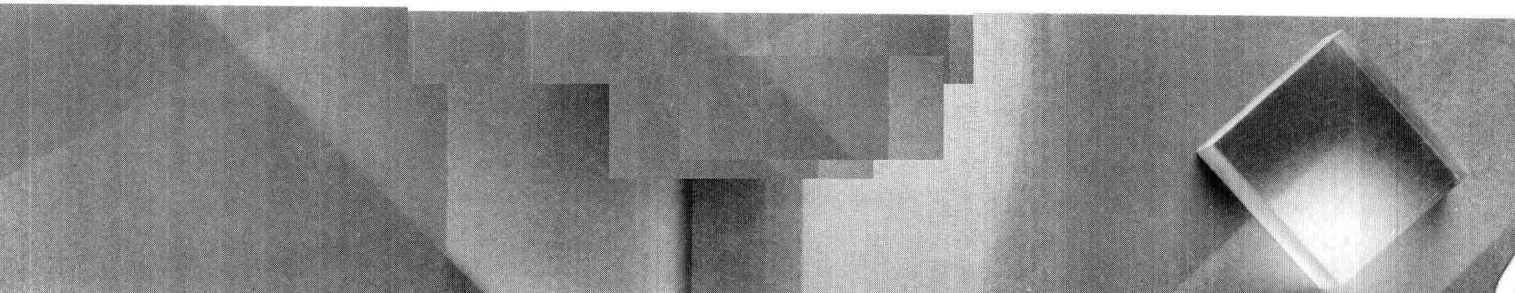
HOUGHTON MIFFLIN COMPANY NEW YORK BOSTON



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Dedication

Allow me to tell a brief story. I remember a trip my wife and I took to my parents' home during the later stages of Cindy's and my education as graduate students. I happened to awake about six in the morning and went down to the kitchen of our old farmhouse because I was thirsty and needed a drink of water. When I walked into the kitchen, I was surprised to see that the lights were already on and my mother was busy working at the kitchen table preparing her lessons for the day. For some reason, the image has always stayed with me. My mother had taught Home Economics since I was in junior high school, and although I was also preparing for a career in education, I had never really thought much about her dedication to what she did.

My mother used hardware and software too. She had a shallow tray containing a substance that looked like Jell-O, and with this equipment and typed or hand-drawn spirit masters she would turn out dittoed pages about nutrition, sewing, childcare, or whatever she was intending to discuss. It was a slow process. First, the master had to be pressed against the "Jell-O" for a few minutes. It was important to align the master carefully or the final product would be crooked. Then, blank sheets of paper were individually pressed against the Jell-O-like material and carefully peeled away to create the handouts. Try to keep my mom's use of technology in mind as you read about the techniques we describe in this book. The contrast is amazing and provides just one indication of the tremendous change that has occurred in a relatively brief period of time.

This story is intended to get you to think about more than the pace of change in our world. While Cindy and I believe strongly that technology can have a profound impact on our schools, our confidence in technology is justified only in classrooms led by dedicated and skillful teachers. We should be amazed and excited by the power of modern technology, but we should remain impressed by the teachers who begin work at six because last year's lesson may not be good enough. This book is dedicated to Frances Grabe and to all teachers like her.

Preface

Sophisticated technology has become so pervasive and intertwined with so many aspects of our private and professional lives that we seldom notice it. We watch movies on DVD and listen to music from CDs or the Internet. Most magazine and television advertisements include e-mail addresses. Video games, ATM machines, fax machines, cellular phones, caller ID, voice mail, personal satellite dishes—the list of technology innovations we have accepted as commonplace goes on and on.

Technology in Classrooms

We wrote this book because technology seldom plays the same natural role in classrooms that it does in other areas of our daily lives. Prominent authorities on education and technology (for instance, Cuban, 2001; Cuban, Kirkpatrick, & Peck, 2001) continue to demonstrate that the resources already available in many K–12 classrooms are often severely underutilized. Many new and experienced teachers simply are not ready to take advantage of the resources already available in most K–12 classrooms. We realize that some teachers are uncertain and anxious about computer hardware, software selection, and which technology-supported learning activities are likely to be useful and productive for their students. If you feel that way, we hope the information and suggestions we provide in this book will move you from apprehension to excitement.

This Text's Priorities and Goals

The title of this book is intended to clearly state our commitment to some specific priorities. First, our emphasis is on *integrating technology.* This phrase is our way of saying our focus is on preparing you to use technology as a powerful tool in helping your students acquire the knowledge and skills of the content area or areas you will teach. If you end up feeling focused on how to use computers, video cameras, and the Internet rather than how to use technology resources to teach reading, mathematics, history, biology, or whatever content area you will teach, we have somehow failed to get our most basic

message across. Second, our emphasis is on *meaningful (student) learning.* We focus primarily on what students can do with technology and argue that some experiences are probably more valuable than others. We do not ignore your own technology skills, but we emphasize preparing you to provide effective learning experiences to students.

This book is both about technology and about teaching and learning. We feel it is important to consider and discuss both areas together. Our primary goals are to:

- Present the different roles technology might play in your classroom
- Provide specific examples of each type of role
- Link proposed classroom uses of technology with content area and technology standards
- Inform you of the necessary technical ins and outs of some applications you might use in implementing each role
- Suggest how teachers might initiate and guide particular technology-supported learning activities in classrooms
- Promote your thinking and reflection about the best uses of technology

As you think about this information, we hope that you will also consider why you and your future students should spend time using technology in the ways we propose. As a teacher, you function in the important role of decision maker. The discussion of classroom learning and how learning is influenced by classroom tasks and activities should help you make decisions about whether you want to devote precious school time to a specific use of technology.

We also hope that as you read this book, you will not assume that school experiences as you know them must remain fixed, with technology somehow finding a way to fit within the existing framework. Some educational leaders are urging both a restructuring of schools and a serious consideration of what schools do. *Technology is functioning as a catalyst* in some of these considerations, and it may serve the same role for you. As you think about how to use technology in your classroom, you will likely find yourself examining broad educational issues. We do not attempt to avoid criticisms of technology. Just remember: In most cases, effective teaching with technology is effective teaching by any means. Criticisms of the way technology has been used may also alert you to more traditional practices that should also be criticized. For example, if many experts put down an overemphasis on drill-and-practice computer software, what do you think these same experts would say if asked to address the heavy use of traditional worksheets? We want you to think carefully about teaching and learning with and without technology.

The Cognitive Perspective on Learning

Our intent is to emphasize technology-facilitated classroom activities in an active learning environment—one that strongly engages the thinking, decision-making, problem-solving, and reasoning behaviors of students. We use the term *cognitive* to refer to these behaviors. To implement effective classroom activities, it is critical that teachers understand the connection between learning tasks and the mental activities of students.

Chapter 2, "Meaningful Learning in an Information Age," establishes the foundation for this connection. Chapter 2 focuses on developing your understanding of cognitive behaviors and explains how cognitive behaviors are influenced by learning tasks. Chapter 2 also includes a special emphasis on what are often called higher-level thinking skills—decision making, problem solving, and reasoning. Because we feel that effective education requires learners to go beyond reception of information to cognitive skills involving judgment, interpretation, and application, we offer some general suggestions regarding the types of experiences that promote the development of such skills. We continue to emphasize this connection between learning and meaningful learning activities in nearly every chapter.

Several of the later chapters focus on computer tools that allow students to create multimedia projects. These chapters culminate in Chapter 9, "Learning from Student Projects: Knowledge as Design and the Design of Hypermedia." Chapter 9 integrates several important topics—technology tools, cooperative learning, and learning from the construction of authentic content-area projects. The projects discussed in Chapter 9 and throughout the book represent practical examples of classroom tasks that encourage meaningful learning.

Features of the Revision

The first edition of *Integrating Technology for Meaningful Learning* appeared in 1996—and here we are, only eight years later, introducing the fourth edition. The rapid transitions between editions have been a necessary consequence of the rapid pace of development and change in technology and some new possibilities for how technology can be applied in classrooms. What has pleased us as we have worked on the various editions has been just how well our original priorities have held up. If anything, themes such as (1) the integration of technology in content-area instruction, (2) authentic technology-supported student projects, and (3) the use of technology to support a more cognitively active approach to learning have become more widely accepted and promoted.

New Features

- ***Increased Emphasis on Internet Applications:*** The prominence of the Internet in modern life and the potential of the Internet for education have simply required that we increase our emphasis on Internet tools and classroom applications. We have already written a book focused specifically on Internet applications, *Integrating the Internet for Meaningful Learning* (Grabe & Grabe, 2000), based on many of the same themes we use here. However, we realize that few courses are focused specifically on Internet applications, and most instructors probably do not require that their students purchase several textbooks. Therefore, this fourth edition of *Integrating Technology for Meaningful Learning* contains two chapters specifically devoted to learning from the Internet (Chapter 5, "The Internet as a Tool for Communication," and Chapter 6, "The Internet as a Tool for Inquiry"). The Internet is discussed in several other chapters as well. Web page authoring is considered as an outlet for student projects in Chapter 9, and Chapter 10 ("Responsible Use of Technology") contains an extended description of methods for providing safe access to Internet resources and a discussion of copyright issues relevant to using and creating web resources as learning activities.

  A much larger proportion of the references included in the end-of-chapter "Resources to Expand Your Knowledge Base" are addresses for Internet sites. These resources are also collected into a convenient "Teacher's Handy Reference," which appears at the end of the book.
- ***Expanded Electronic Resources:*** In addition to emphasizing online applications, we feel it is time to examine seriously how the Internet may change the relationship between authors and learners. It is our intent not only to describe the new resources and experiences the Internet makes available, but to actively engage you in using them. When you purchased this book, you actually acquired a set of resources (book, CDs, Internet access), and we intend each to make a contribution in helping you learn about the classroom uses of technology. We provide additional details regarding what you can expect from our electronic resources at a later point in this preface.
- ***Coverage of Digital Video Applications:*** Digital camcorders and video production software are providing practical opportunities for capturing community-based experiences and reflecting on these experiences. In Chapter 8, "Learning to Work with Images, Sound, and Video," video production is presented as another possibility for authentic student projects. The Internet has also developed to become a more practical method for sharing video content. These opportunities have resulted from more common classroom access to high-speed Internet service, from new video formats, and from new, reasonably priced software and equipment.

- ***Expanded Emphasis on Higher-Order Thinking:*** In previous editions we have emphasized the role technology can play in developing problem-solving capabilities. We now add an emphasis on critical thinking to broaden our consideration of higher-order thinking. With the unregulated access to information provided by the Internet, there is both great need and great opportunity to develop critical thinking skills. Chapter 6, "The Internet as a Tool for Inquiry," elaborates on the concepts of "primary source" and "information problem solving" and outlines instructional models to assist you in developing instructional activities that focus on critical thinking.

Updates and Revisions

- ***Statistics and Research:*** All chapters include more current descriptive statistics to provide a realistic picture of what resources are available in schools and how teachers are using these resources with students. In addition, all chapters include more recent references to the professional literature and new examples of hardware, software, and instructional activities. We include new classroom examples to illustrate what these resources and activities look like in practice.
- ***Coverage of Reform:*** We continue to explore the connection between technology and educational reform. Although the basic goals of educational reform (Chapter 1) do not require computers or other forms of technology, many connections have emerged. Teachers who make greater use of what are described as "constructivist teaching methods" also make greater use of technology (Chapter 2). Technology tools provide many opportunities for engaging students in learning tasks that allow for collaborative work, authentic student-centered exploration, and performance-based assessment.

- ***Coverage of National Standards:*** In conjunction with our discussions of educational reform, we emphasize current national standards for both content learning and technology. Passages particularly relevant to national standards are marked with a marginal icon.
- ***Equity Issues:*** What has become known as the *digital divide* has emerged as a prominent political issue since the publication of early editions of this book. Our discussion of equity reflects new data and new concerns. Chapter 10 considers how and why gender, socioeconomic status, aptitude, and physical or learning disabilities may influence opportunities to learn with technology.
- ***Coverage of Widely Used Applications:*** To make this book as useful as possible for classroom teachers, we concentrate on software and applications that are commonly available and, in most cases, relatively inexpensive. In this edition, for example, we give increased attention to Microsoft PowerPoint presentation software, which has become familiar

in educational as well as corporate settings. We also examine similar software designed especially for student use.

Our Approach Is Anchored in Everyday Classroom Life

We want very much to assure you that what we propose is practical for you to implement. Our strategy for doing this is to rely primarily on our own experiences within our local school district. We decided that it would be unfair for us to piece together a picture of computer and Internet use originating in grant-subsidized schools, high-tech demonstration sites, or what we have gleaned about the latest and greatest applications from the conferences we attend and the journals we read. Yes, the theory, research, and general instructional strategies we describe in this book draw on contributions from a wide range of educational researchers, policy advocates, and demonstration sites. In contrast, however, most of the classroom examples we include come from teachers we know personally.

A few comments about our own backgrounds may provide a context for what we emphasize. The topics and theoretical perspective of this book result from a blend of the orientations, experiences, and individual interests of the two authors.

Mark Grabe's background is in educational psychology—he is a professor in the Psychology Department and the Instructional Design and Technology program at the University of North Dakota. He brings to this collaboration the theoretical perspectives and research experiences more typical of a university faculty member. Mark has been developing instructional software for approximately seventeen years in support of his own research activities. Originally trained to teach high-school biology, he continues to pursue his interest in science education. Some of his first Internet activities involved designing instructional web sites to promote the outdoor educational programs of the North Dakota Department of Game and Fish. This work, which you will catch glimpses of throughout this book, has encouraged an interest in hands-on science and the role technology might play in it.

Cindy Grabe's original certification was as an elementary-school teacher; she later earned a master's degree as a learning disability specialist. After she had worked for many years as a reading specialist, her interest and experience in the use of technology in instruction led her to a full-time technology position with the Grand Forks school district. She has been a technology facilitator, a position that in some districts may be described as a computer coordinator, for twelve years. Her position requires that she provide training to district teachers, administrators, and staff members, collaborate on curriculum projects, and conduct demonstration activities with students. She is involved in providing continuing educational experiences for teachers in area schools,

and she teaches courses for undergraduate preservice teachers at the University of North Dakota. Recently half of her K–12 contract has been acquired by the university so that she can assist the university in implementing a multiyear grant intended to increase the frequency of technology-based experiences in the fieldwork of future teachers. Cindy deals directly and continuously with the very practical issues of integrating technology in classrooms. Her own work with students and her associations with many gifted classroom teachers are responsible for most of the classroom examples we provide in this book. Cindy has been recognized as an Apple Distinguished Educator by the Apple Computer Corporation.

Learning Features of the Text

Throughout the book you will find special features designed to help you better understand important concepts and use them in your own classroom.

Scenes from Real Classrooms

Descriptions of actual classroom events can provide a powerful way to "see" in action many of the ideas we present. Stories of classroom events and descriptions of actual student projects are embedded in many chapters as demonstrations of teacher or student behavior.

Screen Images and Program Examples

The graphics in this book are mostly images captured as they appear on the computer screen. You may not always have immediate access to the computer tools or the Internet resources we describe, so these images are a convenient way to help you understand what the text explains. Visual examples are one of the best ways to explain topics such as web page design and to present samples from student projects.

Special Features: "Focus," "Spotlight on Assessment," "Keeping Current," and "Emerging Technology"

The features that appear under the general titles "Focus," "Spotlight on Assessment," "Keeping Current," and "Emerging Technology" allow us freedom to break away from the main thrust of a presentation and consider a topic in more detail. The topic might involve an extended discussion of an important issue or theory, a suggestion for how a teacher might evaluate a student project, or the description of a new type of application that has promise for classroom use. Setting these discussions apart allows you to consider the topics independently from the main discussion.

Activities and Projects for Your Classroom

We include a large number of application ideas in this book, but we also recognize that teachers work in many disciplines with students of different ages. The features called "Activities and Projects for Your Classroom" allow us to list variations of applications that might be more discipline- or age-specific. The combination of the extended examples and the variations provided within the activity features is a reasonable way to acquaint you with classroom applications.

End-of-Chapter Activities

Following the text of each chapter, we include several activities we suggest you try. These activities are our attempt to get you to think more actively about important issues presented in the chapters or to try out an application we have described. We have attempted to generate activities that can be accomplished with and without direct access to computer resources, so you should be able to complete at least some of the brief tasks no matter what your circumstances. It would clearly be inconsistent for us to suggest that you can learn meaningfully using only a textbook. We trust that this book will not be the only resource at your disposal and that you will also learn a great deal from teachers and colleagues.

End-of-Chapter Resources to Expand Your Knowledge Base

Each chapter ends with annotated lists of resources that offer further information about the topics, software, and hardware covered in the chapter. We include a variety of resource types, but we have made a decision to emphasize a greater number of web sites than in previous editions. A summary of these web sites has been organized as the "Teacher's Handy Reference" that appears at the end of the book.

Accompanying Teaching and Learning Resources

As we mentioned previously, we are making a serious attempt to offer you more than a book. We hope to continue writing textbooks into the future because we feel that traditional books are the most effective way to accomplish certain goals. However, we believe that authors and publishing companies can now use electronic resources, including the Internet, to offer additional experiences that go far beyond ordinary textbook supplements.

Web Resources

Your purchase of this book entitles you to access two web sites. The first site, the official online resource for this book, is maintained by Houghton Mifflin Company. You can access it by directing your web browser to **http://education.college.hmco.com/students** and then selecting the specific site for this text. The resources available at this site include:

- Chapter summaries updated to ensure accuracy.
- Direct links to external online resources mentioned in the book, plus a searchable database of web links. These links are updated much more frequently than the printed book can be revised.
- ACE self-testing quizzes for each chapter.
- Additional examples of student projects, extending those provided in the book. Some of these include short video segments.
- Numerous essays on special topics, offering self-contained discussions of issues not included in the book.

Instructors have their own section of the textbook site, where they can access all of the student resources as well as PowerPoint slides and other instructional aids.

Here and there throughout the book, you will see a marginal icon, like the one in the margin here, indicating that material relevant to the topic under discussion can be found on the Houghton Mifflin web site. These icons only hint at the resources available, however; there are many features of the web site that you will learn about only by exploring the site itself.

You are also welcome to access a second web site maintained by the authors (**http://ndwild.psych.und.nodak.edu/book/**). We use our own site to:

- Develop resources that will eventually appear on the Houghton Mifflin site
- Experiment with new ideas, formats, and tools
- Provide examples of products and services characteristic of the Internet technology available in a typical K–12 school

We encourage you to explore the resources provided at both sites and use whatever is best suited to your needs.

Student CD-ROM

The complimentary CD-ROM included with your text has been greatly enhanced since the previous edition. It now contains:

- Additional web links on important topics such as constructivism, assessment of student multimedia projects, and adaptive and assistive technology.
- Video clips that allow you to watch teachers and students in action. For example, you can watch a class undertaking an Internet-based inquiry project.

- Reflection questions for each video clip that help you think about the implications of what you are seeing. You can record your reflections and turn them in to your professor as well.
- A review of the book's glossary terms, to help you build your vocabulary.

As with the textbook web site, we use marginal icons throughout the book to remind you to check the CD.

Acknowledgments

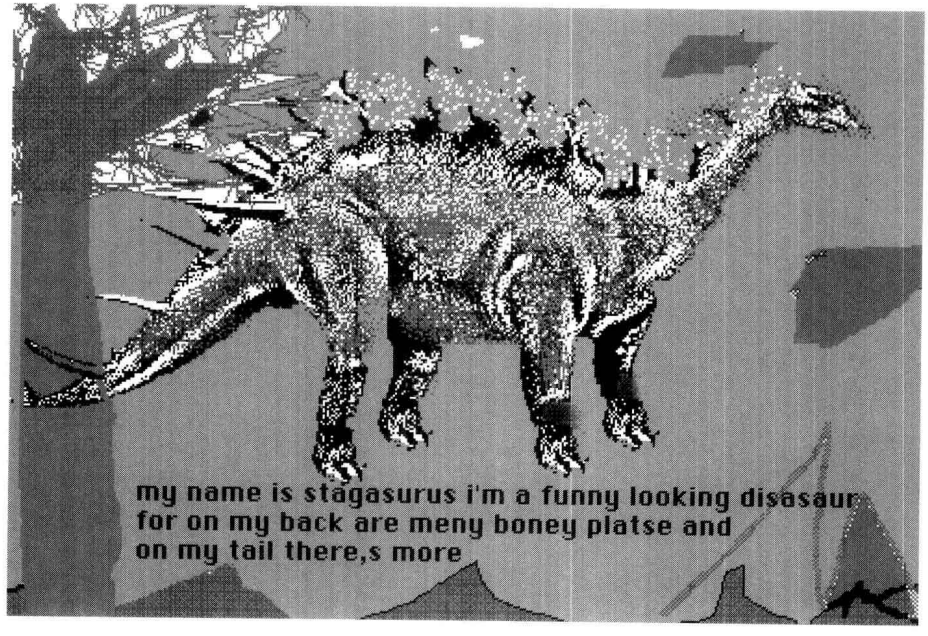
We owe many individuals our gratitude for helping us bring this book to you. Some years ago now, Loretta Wolozin, senior sponsoring editor at Houghton Mifflin, saw in our original proposal the germ of a unique idea and made the trip to North Dakota to talk with us and examine student projects. Putting students in control of powerful tools was not typical, and yet Loretta has supported our belief that this theme should be at the core of what teachers learn about the classroom applications of technology. When Loretta retired from Houghton Mifflin, she was replaced by Sue Pulvermacher-Alt. We are pleased to say that we have continued to receive encouragement and support for the approach we have taken. We were assisted in preparing this edition by the guidance of developmental editor Doug Gordon. This is the second book Doug has helped us write. We respect his guidance in improving the structure of the information we present and also his personal knowledge of technology. We hope you will find our arguments and explanations clear and our style friendly. Jane Lee, the project editor, was responsible for the tedious tasks associated with page and chapter layout, matching hundreds of citations and references, and polishing our prose. Lisa Mafrici, senior development editor, has worked with us now for several years. She helped organize our efforts and kept us focused on deadlines and our revision goals. We would also like to thank the reviewers whose insightful reviews and feedback informed the development of this edition: Robert Lucking, Old Dominion University; David A. McCarthy, University of Minnesota, Duluth; Beverly J. Reil, Bellevue Community College; and John Roseman, University of LaVerne. No book really results from the work of the authors alone, and this book is no exception.

Finally, we owe a giant debt to the many teachers and students who provided the authentic examples we have included. The quality and creativity of the products and the enthusiasm of the individuals who created them impressed us. We hope these examples will inspire your own work, too.

A Final Word

It is not always possible to determine where ideas originate, but we know exactly how we began working with student-authored multimedia. Nearly twelve years ago we were preparing for a workshop in which Cindy planned to introduce Kid Pix to a group of teachers. The teachers were involved in the decision-making process to decide what equipment and software the district would purchase, and we were attempting to develop a convincing argument for the value of tool applications and student-authored multimedia. We were just learning Kid Pix ourselves and were searching for something that would get the teachers excited. Our youngest daughter, Kim (then in first grade, now in college), had been studying dinosaurs, so we scanned a picture of a dinosaur. We asked Kim to use Kid Pix to color the picture and then record a song she had learned about dinosaurs. We were pleased with the result and decided to use the product as part of our presentation.

As we continued to work on other parts of the workshop, Kim remained at the computer, singing the dinosaur song over and over. It turned out she was singing as she typed in the lyrics. At the time, it was her persistence and innovation in going beyond our initial request that impressed us. We have since had similar experiences with many learners. We saved Kim's picture and still listen to her song from time to time. Because we have thanked many



Kim's Original Multimedia Project (Converted to Grayscale)

people in this preface, we should also thank Kim, who is owed some recognition simply for being so tolerant of the work habits of her parents. Her own creative talents and her enthusiasm for learning have served to inspire us for what have now been quite a few years. We know students enjoy working in the ways we describe partly because we have had the opportunity to watch and work with them.

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