INFORMATICS
FOR HEALTH PROFESSIONALS

Kathleen Garver Mastrian
Dee McGonigle

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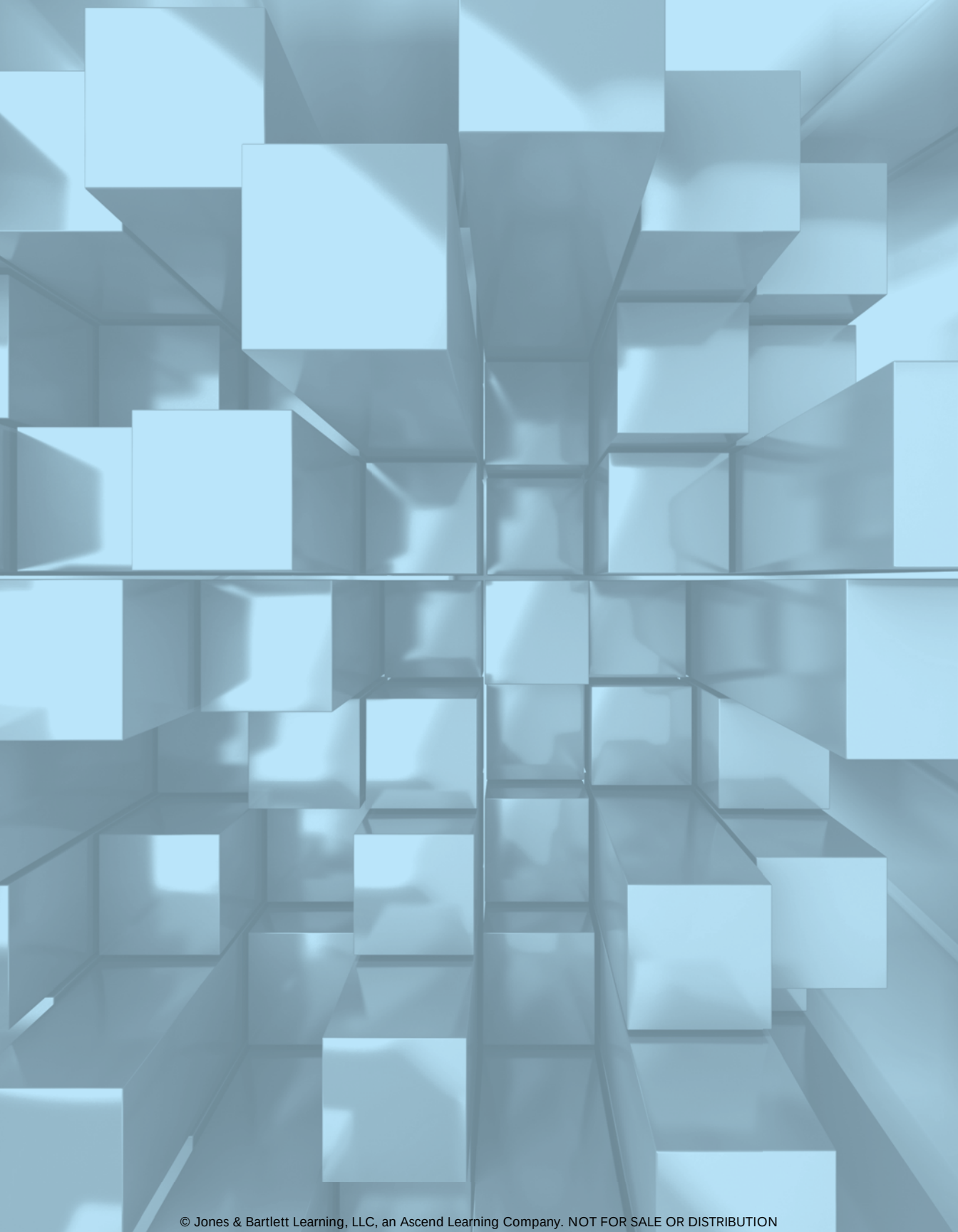

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INFORMATICS
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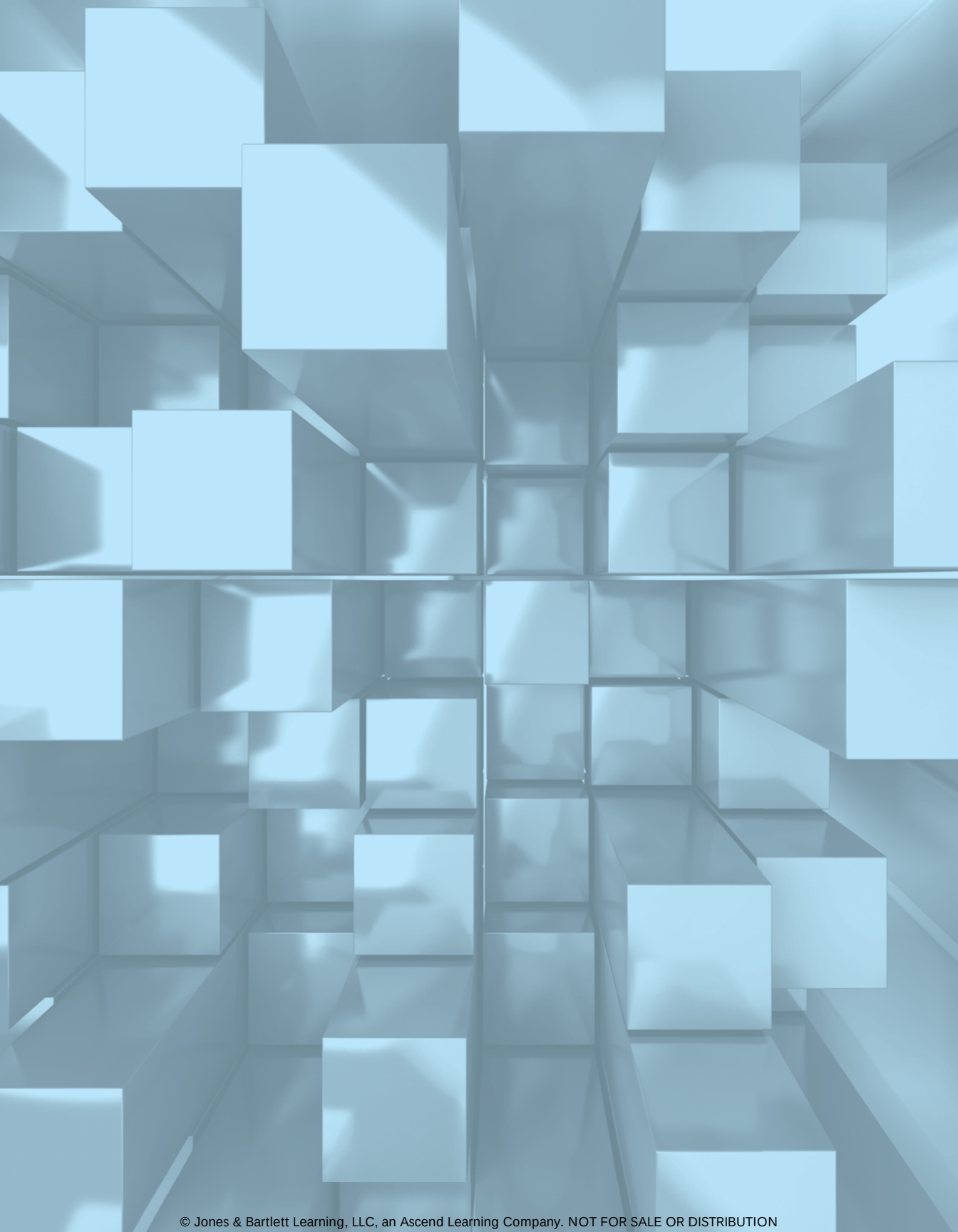

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Preface

Authors' Note

This text provides an overview of health informatics from the perspective of diverse experts in the field, with a focus on health informatics and the Foundation of Knowledge model. We want our readers and students to focus on the relationship of knowledge to informatics and to embrace and maintain the caring functions essential to all of health care—messages all too often lost in the romance with technology. We hope you enjoy the text!

About this Book

The idea for this text originated with the publication of the third edition of *Nursing Informatics and the Foundation of Knowledge* (2015). We realized that other health care professionals also needed to learn about informatics and the ways that informatics supports professional practice. We know that the idea of informatics is new to many health care professionals, and we believe that all health care professionals need to be better prepared for 21st-century practice by developing a strong foundation in informatics.

According to the Association of Schools of Allied Health Professions (http://www.asahp.org/wp-content/uploads/2014/08/Health-Professions-Facts.pdf), allied health professionals represent 60% of the health workforce and are "the segment of the workforce that delivers services involving the identification, evaluation and prevention of diseases and disorders; dietary and nutrition services; and rehabilitation and health systems management" (para 1). Specifically, this text is designed to introduce dental hygienists, diagnostic medical sonographers, dietitians, medical technologists, occupational therapists, physical therapists, radiographers, respiratory therapists, and speech-language pathologists to health informatics.

Collectively, we have years of experience teaching and writing about informatics. Like most nurse informaticists, we fell into the specialty; our love affair with technology and gadgets and our willingness to be the first to try new things helped to hook us into the specialty of informatics. The rapid evolution of technology in the health care system and the role of technology in the transformation of the system initially prompted us to try to capture the

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essence of nursing informatics in a text. Here is a bit of background on the nursing informatics text evolution that helped to set the stage for this text.

As we were developing the first edition, we realized that we could not possibly know all there is to know about informatics and the way in which it supports practice, education, administration, and research. We also knew that our faculty roles constrained our opportunities for exposure to changes in this rapidly evolving field. Therefore, we developed a tentative outline and a working model of the theoretical framework for the text and invited participation from informatics experts and specialists around the world. We were pleased with the enthusiastic responses we received from some of those invited contributors and a few volunteers who heard about the text and asked to participate in their particular area of expertise. In this textbook, we have retained some of this valuable information from these original contributors to the first edition of the nursing informatics text.

We believe that this text provides a comprehensive elucidation of this exciting field. The theoretical underpinning of the text is the Foundation of Knowledge model. This model is introduced in its entirety in the first chapter (*Informatics, Disciplinary Science, and the Foundation of Knowledge*), which discusses disciplinary science and its relationship to health informatics. We believe that humans are organic information systems that are constantly acquiring, processing, and generating information or knowledge in both their professional and their personal lives. It is their high degree of knowledge that characterizes humans as extremely intelligent, organic machines. Individuals have the ability to manage knowledge—an ability that is learned and honed from birth. We make our way through life interacting with our environment and being inundated with information and knowledge. We experience our environment and learn by acquiring, processing, generating, and disseminating knowledge. As we interact in our environment, we acquire knowledge that we must process. This processing effort causes us to redefine and restructure our knowledge base and generate new knowledge. We then share (disseminate) this new knowledge and receive feedback from others. The dissemination and feedback initiate this cycle of knowledge over again as we acquire, process, generate, and disseminate the knowledge gained from sharing and reexploring our own knowledge base. As others respond to our knowledge dissemination and we acquire new knowledge, we engage in rethinking and reflecting on our knowledge, processing, generating, and then disseminating anew.

The purpose of this text is to provide a set of practical and powerful tools to ensure that the reader gains an understanding of health informatics and moves from information through knowledge to wisdom. Defining the demands of health professionals and providing tools to help them survive and succeed in the Knowledge Era remains a major challenge. Exposing allied health students to the principles and tools used in health informatics helps to prepare them to meet the challenge of practicing in the Knowledge Era while striving to improve patient care at all levels.

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The text provides a comprehensive framework that embraces knowledge so that readers can develop their knowledge repositories and the wisdom necessary to act on and apply that knowledge. The text is divided into five sections:

- The *Building Blocks of Health Informatics* (HI) section covers the building blocks of HI: disciplinary science, information science, computer science, cognitive science, and the ethical and legal aspects of managing information.
- The *Choosing and Using Information Systems* section explains how systems are developed, covers important functions of administrative application systems in health care, discusses the human–technology interface, provides important information on electronic security, and explains work flow and meaningful use in relation to electronic systems.
- The *Informatics Applications for Care Delivery* section covers health care delivery applications including electronic health records (EHRs), patient engagement and connected health, patient safety and quality outcomes technologies, interdisciplinary collaboration, and informatics tools for community and population health promotion.
- The *Advanced Concepts in Health Informatics* section presents subject matter on informatics tools for health professional education, data mining, translational research for generating best practices, and the exciting fields of bioinformatics and computational biology.
- The *Practice in the Future* section focuses on the future of health informatics, emphasizes the need to preserve caring and patient-centered functions in technology-laden environments, and summarizes the relationship of informatics to the Foundation of Knowledge model and organizational knowledge management.

The introduction to each section explains the relationship between the content of that section and the Foundation of Knowledge model. This text places the material within the context of knowledge acquisition, processing, generation, and dissemination. It serves health care professionals who need to understand, use, and evaluate knowledge. Throughout the text where appropriate, we have included case scenarios demonstrating why a topic is important and research briefs presented in text boxes to encourage the reader to access current research and to focus on cutting-edge innovations, meaningful use, and patient safety as appropriate to each topic.

As college professors, our major responsibility is to prepare the practitioners and leaders in the field. Our primary objective is to develop the most comprehensive and user-friendly HI text on the market to prepare health professionals for current and future practice challenges. In particular, this text provides a solid groundwork from which to integrate informatics principles into practice.

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Goals of this text are as follows:

- Impart core HI principles that should be familiar to every health professional.
- Help the reader understand knowledge and how it is acquired, processed, generated, and disseminated.
- Demonstrate the value of the HI discipline as an attractive field of specialization.

The overall vision, framework, and pedagogy of this text offers benefits to readers by highlighting established principles while drawing out new ones that continue to emerge as health care and technology evolve.

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We are deeply grateful to the contributors who provided this text with a richness and diversity of content that we could not have captured alone. Joan Humphrey provided social media content integrated throughout the text. We especially wish to acknowledge the superior work of Alicia Mastrian, graphic designer of the Foundation of Knowledge model, which serves as the theoretical framework on which this text is anchored. We would also like to thank Craig McGonigle for his insightful contributions to this text. We could never have completed this project without the dedicated and patient efforts of the Jones & Bartlett Learning staff, especially Cathy Esperti, Sara Peterson, and Carter McAlister. Both fielded our questions and concerns in a very professional and respectful manner.

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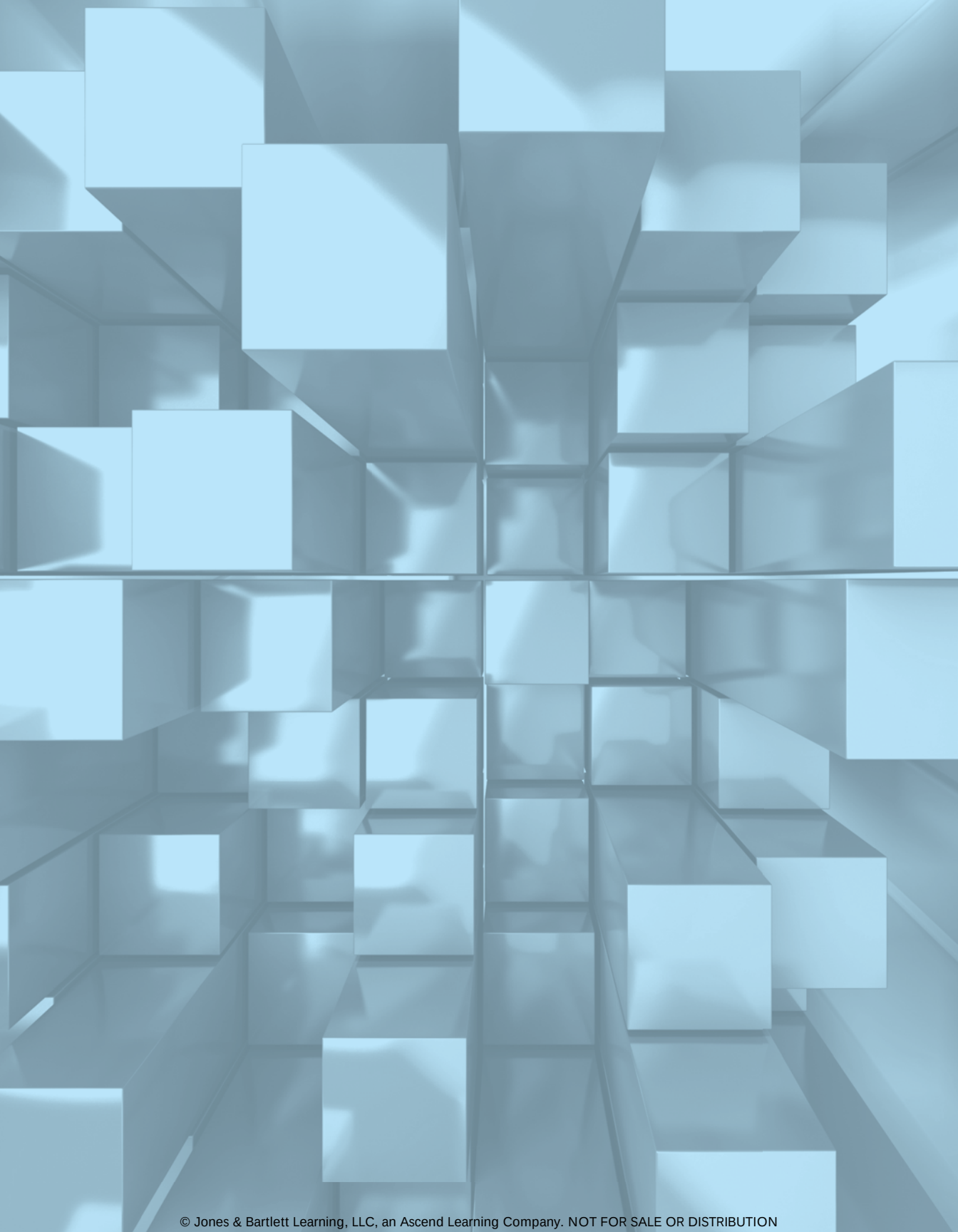

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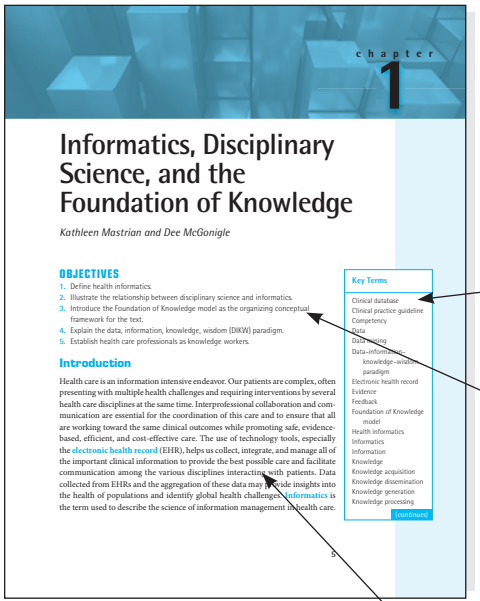
A Visual Walkthrough

Informatics for Health Professionals drives comprehension through a variety of strategies geared toward meeting the learning needs of students while also generating enthusiasm about the topic. This interactive approach addresses diverse learning styles, making this the ideal text to ensure mastery of key concepts. The pedagogical aids that appear in most chapters include the following:



chapter 1

Informatics, Disciplinary Science, and the Foundation of Knowledge

Kathleen Mastrian and Dee McGonigle

OBJECTIVES

1. Define health informatics.
2. Illustrate the relationship between disciplinary science and informatics.
3. Introduce the Foundation of Knowledge model as the organizing conceptual framework for the text.
4. Explain the data, information, knowledge, wisdom (DIKW) paradigm.
5. Establish health care professionals as knowledge workers.

Introduction

Health care is an information intensive endeavor. Our patients are complex, often presenting with multiple health challenges and requiring interventions by several health care disciplines at the same time. Interprofessional collaboration and communication are essential for the coordination of this care and to ensure that all are working toward the same clinical outcomes while promoting safe, evidence-based, efficient, and cost-effective care. The use of technology tools, especially the **electronic health record** (EHR), helps us collect, integrate, and manage all of the important clinical information to provide the best possible care and facilitate communication among the various disciplines interacting with patients. Data collected from EHRs and the aggregation of these data may provide insights into the health of populations and identify global health challenges. **Informatics** is the term used to describe the science of information management in health care.

Key Terms

Clinical database
Clinical practice guideline
Competency
Data
Data mining
Data–information–knowledge–wisdom paradigm
Electronic health record
Evidence
Feedback
Foundation of Knowledge model
Health informatics
Informatics
Information
Knowledge
Knowledge acquisition
Knowledge dissemination
Knowledge generation
Knowledge processing

(continues)

Key Terms

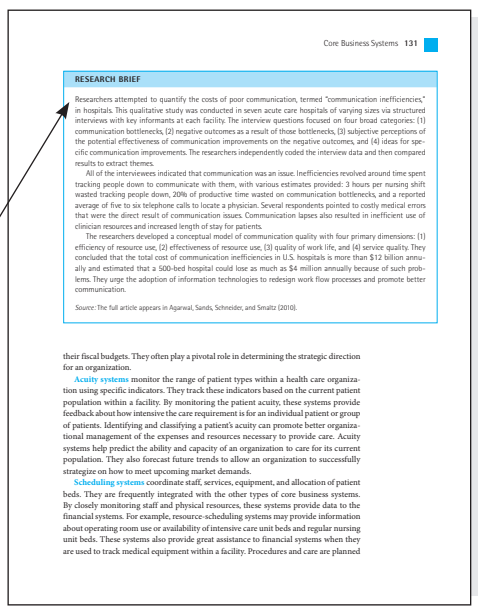
Found in a list at the beginning of each chapter, these terms will create an expanded vocabulary. The "www" icon directs students to the text's online resources, where they can review these terms in an interactive glossary and use flash cards to nail down their definitions. Use the access code at the front of your book to access these additional resources. If you do not have an access code, one can be purchased at http://www.jblearning.com.

Objectives

The chapter objectives provide instructors and students with a snapshot of the key information they will encounter in each chapter. They serve as a checklist to help guide and focus study. Objectives can also be found within the text's online resources.

Introductions

Found at the beginning of each chapter, chapter introductions provide an overview highlighting the importance of the chapter's topic. They also help keep students focused as they read.



RESEARCH BRIEF

Researchers attempted to quantify the costs of poor communication, termed "communication inefficiencies," in hospitals. This qualitative study was conducted in seven acute care hospitals of varying sizes via structured interviews with key informants at each facility. The interview questions focused on four broad categories: (1) communication bottlenecks, (2) negative outcomes as a result of those bottlenecks, (3) subjective perceptions of the potential effectiveness of communication improvements on the negative outcomes, and (4) ideas for specific communication improvements. The researchers independently coded the interview data and then compared results to extract themes.

All of the interviewees indicated that communication was an issue. Inefficiencies revolved around time spent tracking people down to communicate with them, with various estimates provided: 3 hours per nursing shift wasted tracking people down, 20% of productive time wasted on communication bottlenecks, and a reported average of five to six telephone calls to locate a physician. Several respondents pointed to costly medical errors that were the direct result of communication issues. Communication lapses also resulted in inefficient use of clinician resources and increased length of stay for patients.

The researchers developed a conceptual model of communication quality with four primary dimensions: (1) efficiency of resource use, (2) effectiveness of resource use, (3) quality of work life, and (4) service quality. They concluded that the total cost of communication inefficiencies in U.S. hospitals is more than $12 billion annually and estimated that a 500-bed hospital could lose as much as $4 million annually because of such problems. They urge the adoption of information technologies to redesign work flow processes and promote better communication.

Source: The full article appears in Agarwal, Sands, Schneider, and Smaltz (2010).

their fiscal budgets. They often play a pivotal role in determining the strategic direction for an organization.

Acuity systems monitor the range of patient types within a health care organization using specific indicators. They track these indicators based on the current patient population within a facility. By monitoring the patient acuity, these systems provide feedback about how intensive the care requirement is for an individual patient or group of patients. Identifying and classifying a patient's acuity can promote better organizational management of the expenses and resources necessary to provide care. Acuity systems help predict the ability and capacity of an organization to care for its current population. They also forecast future trends to allow an organization to successfully strategize on how to meet upcoming market demands.

Scheduling systems coordinate staff, services, equipment, and allocation of patient beds. They are frequently integrated with the other types of core business systems. By closely monitoring staff and physical resources, these systems provide data to the financial systems. For example, resource-scheduling systems may provide information about operating room use or availability of intensive care unit beds and regular nursing unit beds. These systems also provide great assistance to financial systems when they are used to track medical equipment within a facility. Procedures and care are planned

Research Briefs

These summaries encourage students to access current research in the field.

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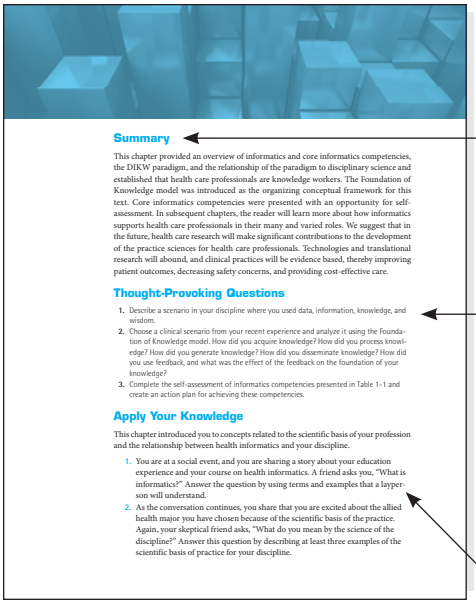


Summary

This chapter provided an overview of informatics and core informatics competencies, the DIKW paradigm, and the relationship of the paradigm to disciplinary science and established that health care professionals are knowledge workers. The Foundation of Knowledge model was introduced as the organizing conceptual framework for this text. Core informatics competencies were presented with an opportunity for self-assessment. In subsequent chapters, the reader will learn more about how informatics supports health care professionals in their many and varied roles. We suggest that in the future, health care research will make significant contributions to the development of the practice sciences for health care professionals. Technologies and translational research will abound, and clinical practices will be evidence based, thereby improving patient outcomes, decreasing safety concerns, and providing cost-effective care.

Thought-Provoking Questions

1. Describe a scenario in your discipline where you used data, information, knowledge, and wisdom.
2. Choose a clinical scenario from your recent experience and analyze it using the Foundation of Knowledge model. How did you acquire knowledge? How did you process knowledge? How did you generate knowledge? How did you disseminate knowledge? How did you use feedback, and what was the effect of the feedback on the foundation of your knowledge?
3. Complete the self-assessment of informatics competencies presented in Table 1–1 and create an action plan for achieving these competencies.

Apply Your Knowledge

This chapter introduced you to concepts related to the scientific basis of your profession and the relationship between health informatics and your discipline.

1. You are at a social event, and you are sharing a story about your education experience and your course on health informatics. A friend asks you, "What is informatics?" Answer the question by using terms and examples that a layperson will understand.
2. As the conversation continues, you share that you are excited about the allied health major you have chosen because of the scientific basis of the practice. Again, your skeptical friend asks, "What do you mean by the science of the discipline?" Answer this question by describing at least three examples of the scientific basis of practice for your discipline.

Summaries

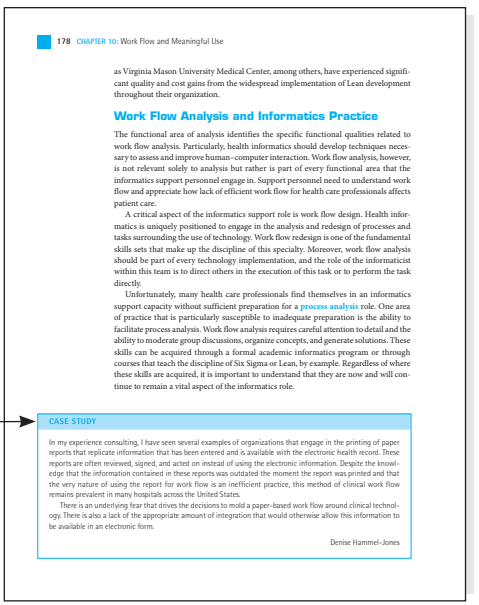
Summaries are included at the end of each chapter to provide a concise review of the material covered, highlighting the most important points and describing what the future holds.

Thought-Provoking Questions

Students can work on these critical thinking assignments individually or in a group while reading through the text. In addition, students can delve deeper into concepts by completing these exercises online.

Apply Your Knowledge

Each chapter contains a content application scenario to promote active learning and critical thinking skills. These activities may be assigned individually to students or may be used as group activities. We believe that when used as group activity, there is better understanding and knowledge building potential. To use as a group activity, we suggest the following directions to students: Huddle with a fellow student or a team of students to read and craft responses to the application scenario. Share your responses, and compare and contrast them to craft a consensus response for the class. These activities also work well in an electronic environment with students chatting online synchronously or asynchronously in a discussion forum.



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as Virginia Mason University Medical Center, among others, have experienced significant quality and cost gains from the widespread implementation of Lean development throughout their organization.

Work Flow Analysis and Informatics Practice

The functional area of analysis identifies the specific functional qualities related to work flow analysis. Particularly, health informatics should develop techniques necessary to assess and improve human–computer interaction. Work flow analysis, however, is not relevant solely to analysis but rather is part of every functional area that the informatics support personnel engage in. Support personnel need to understand work flow and appreciate how lack of efficient work flow for health care professionals affects patient care.

A critical aspect of the informatics support role is work flow design. Health informatics is uniquely positioned to engage in the analysis and redesign of processes and tasks surrounding the use of technology. Work flow redesign is one of the fundamental skills sets that make up the discipline of this specialty. Moreover, work flow analysis should be part of every technology implementation, and the role of the informaticist within this team is to direct others in the execution of this task or to perform the task directly.

Unfortunately, many health care professionals find themselves in an informatics support capacity without sufficient preparation for a **process analysis** role. One area of practice that is particularly susceptible to inadequate preparation is the ability to facilitate process analysis. Work flow analysis requires careful attention to detail and the ability to moderate group discussions, organize concepts, and generate solutions. These skills can be acquired through a formal academic informatics program or through courses that teach the discipline of Six Sigma or Lean, by example. Regardless of where these skills are acquired, it is important to understand that they are now and will continue to remain a vital aspect of the informatics role.

CASE STUDY

In my experience consulting, I have seen several examples of organizations that engage in the printing of paper reports that replicate information that has been entered and is available with the electronic health record. These reports are often reviewed, signed, and acted on instead of using the electronic information. Despite the knowledge that the information contained in these reports was outdated the moment the report was printed and that the very nature of using the report for work flow is an inefficient practice, this method of clinical work flow remains prevalent in many hospitals across the United States.

There is an underlying fear that drives the decisions to mold a paper-based work flow around clinical technology. There is also a lack of the appropriate amount of integration that would otherwise allow this information to be available in an electronic form.

Denise Hammel-Jones

Case Studies

Case studies encourage active learning and promote critical thinking skills. Students can ask questions, analyze situations, and solve problems in a real-world context.

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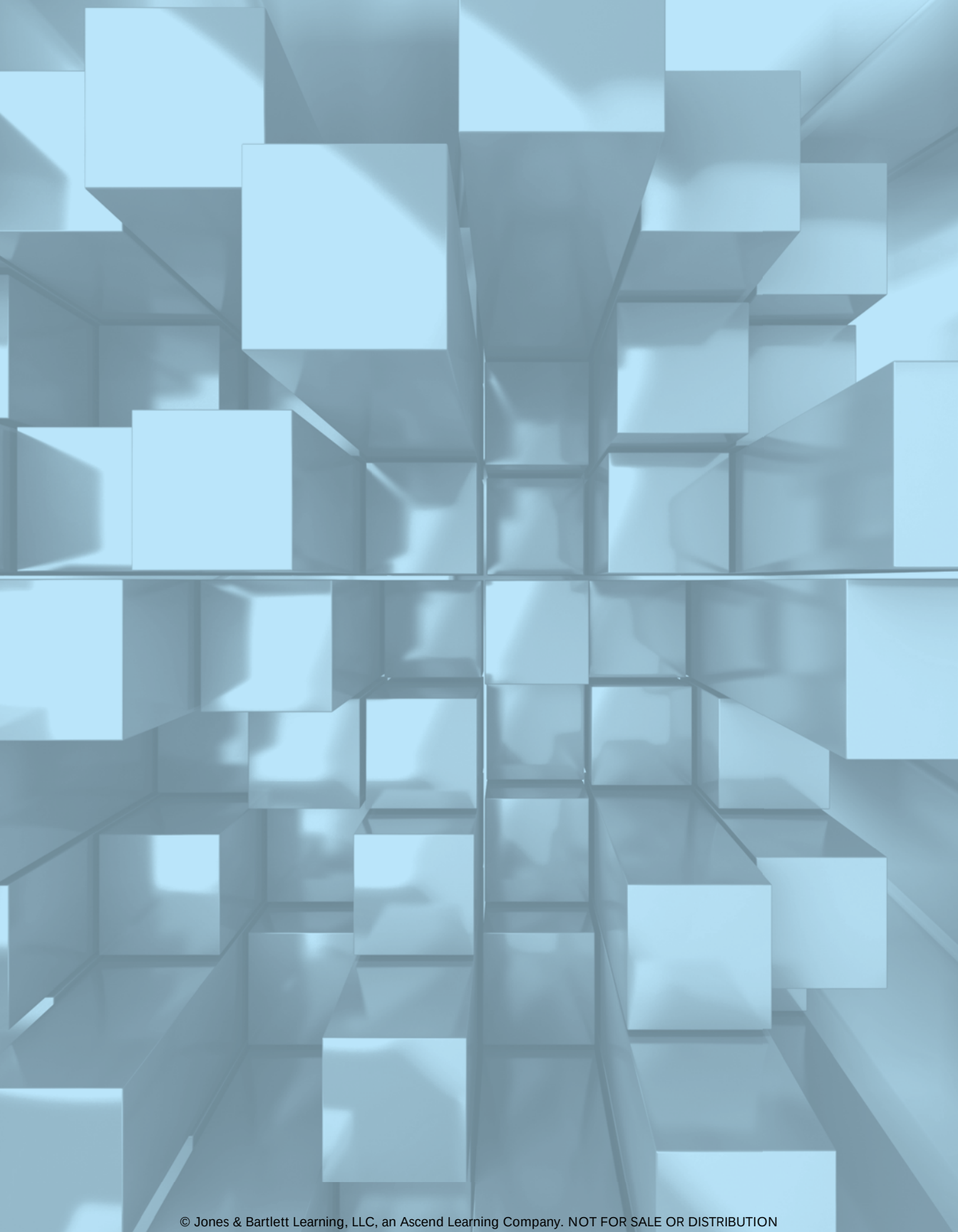

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