WHAT YOUR COLLEAGUES ARE SAYING . . .

AI has transformed education, but since everything is so new, students and teachers are still looking for the best ways to benefit from it. The authors have broken down a complex, rapidly evolving subject and generated a framework for teaching AI literacy to K–12 students. This book provides a foundation for distinguishing science from fiction and for avoiding the pitfalls that come with the recent breakthroughs in AI.

—Philippos Mordohai
Professor of Computer Science, Stevens Institute of Technology
Hoboken, NJ

An accessible entry point into the complex world of AI education, this foundational resource establishes and explains core concepts while inspiring educators to delve deeper into AI literacy across disciplines. It is a valuable launching pad for the further development of AI fluency.

—Sonja Strydom
Deputy Director, Centre for Learning Technologies,
Stellenbosch University
Stellenbosch, South Africa

This handbook is a valuable resource for educators and educational researchers. It offers practical ways and resources for integrating AI literacy into various subjects, addressing the interdisciplinary nature of AI. This book will show us how to apply AI to transform K–12 learning. It is a must-read for everyone who wants to prepare the future generation for the AI era.

—Thomas Chiu
Assistant Professor, The Chinese University of Hong Kong
Program Coordinator, BSc Learning Design and Technology
Ma Liu Shui, Hong Kong

This is a great addition to your resource library. The authors do a tremendous job of laying the foundation for why addressing AI literacy is so vital. They follow it up with some helpful examples of how to do this within existing content that is taught.

—Kevin Dykema
District Math Specialist, Mattawan Consolidated Schools
Mattawan, MI

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The rapid development of Generative AI has brought us to an inflection in both society and education. This excellent book by Lyublinskaya and Du is a timely, balanced, and incisive resource. It offers highly practical guidance for educators aiming to effectively serve their students and society as we navigate these transformative times.

—Rian Roux
Lecturer (Pathways), University of Southern Queensland
Toowoomba, Queensland, Australia

At a time when artificial intelligence is reshaping every aspect of our lives, this book provides a timely guide for educators. Bridging theory and practice, the authors explain basic AI concepts and offer a framework, practical tools and lesson examples that can be used by educators to develop students' critical AI literacy skills.

—Manolis Mavrikis
Professor of Artificial Intelligence in Education,
University College London
London, UK

Teaching AI Literacy Across the Curriculum: A K–12 Handbook *is a must-read for educators seeking to integrate AI literacy into their teaching. This comprehensive guide offers a pedagogical framework, practical tools, and over 20 lesson ideas, making AI accessible without needing advanced technical skills. Emphasizing ethical and responsible AI use, it equips teachers to foster 21st-century digital literacy across all subjects and grade levels. It is highly recommended for K–12 educators.*

—Zsolt Lavicza
Professor, Johannes Kepler UniversityLinz,
Upper Austria, Austria

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Teaching AI Literacy Across the Curriculum

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Teaching AI Literacy Across the Curriculum

A K–12 Handbook

Irina Lyublinskaya

Xiaoxue Du

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(800) 233-9936
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Table of Subject-Specific Standards

STANDARD	ABBREVIATION	EXPLAINED	SUBJECT	PAGE REFERENCE
CCSS.ELA-Literacy	RF.2.3	Know and apply grade-level phonics and word-analysis skills in decoding words.	ELA	156
CCSS.ELA-Literacy	L.4.4	Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on Grade 4 reading and content, choosing flexibly from a range of strategies.	ELA	161
CCSS.ELA-Literacy	RL.6.3	Describe how a particular story's or drama's plot unfolds in a series of episodes as well as how the characters respond or change as the plot moves toward a resolution.	ELA	152
CCSS.ELA-Literacy	RI.7.2	Determine two or more central ideas in a text and analyze their development over the course of the text; provide an objective summary of the text.	ELA	166
CCSS.ELA-Literacy	W.8.1	Write arguments to support claims with clear reasons and relevant evidence.	ELA	168
CCSS.ELA-Literacy	W.9-10.1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.	ELA	159

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STANDARD	ABBREVIATION	EXPLAINED	SUBJECT	PAGE REFERENCE
CCSS.ELA-Literacy	SL.11-12.1	Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on Grades 11–12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.	ELA	163
CCSS.Math. Content	3.OA.B.5	Apply properties of operations as strategies to multiply and divide.	Mathematics	127
CCSS.Math. Content	3.OA.D.9	Identify arithmetic patterns (including patterns in the addition table or multiplication table), and explain them using properties of operations.	Mathematics	120
CCSS.Math. Content	6.SP.B.5	Summarize numerical data sets in relation to their context.	Mathematics	116
CCSS.Math. Content	7.RP.A	Analyze proportional relationships and use them to solve real-world and mathematical problems.	Mathematics	131
CCSS.Math. Content	8.G.A.2	Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.	Mathematics	124
CCSS.Math. Content	HSA-APR.A.1	Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.	Algebra	134

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STANDARD	ABBREVIATION	EXPLAINED	SUBJECT	PAGE REFERENCE
CCSS.Math. Content	HSA-SSE.A.2	Use the structure of an expression to identify ways to rewrite it.	Algebra	134
CCSS.Math. Content	HSS-ID.B.6	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.	Statistics and Probability	122
CCSS.Math. Content	HSF-LEA.1	Distinguish between situations that can be modeled with linear functions and with exponential functions	Statistics and Probability	129
CCSS.Math. Content	HSS-CP.A.2	Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if they are independent.	Statistics and Probability	118
ISTE	1.1	Empowered Learner: Students leverage technology to take an active role in choosing, achieving, and demonstrating competency in their learning goals, informed by the learning sciences.	Computer Science	39, 41, 44, 46, 49, 52, 70
ISTE	1.3	Knowledge Constructor: Students critically curate a variety of resources using digital tools to construct knowledge, produce creative artifacts, and make meaningful learning experiences for themselves and others.	Computer Science	70
ISTE	1.4	Innovative Designer: Students use a variety of technologies within a design process to identify and solve problems by creating new, useful, or imaginative solutions.	Computer Science	39, 41, 44, 46, 49, 52

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STANDARD	ABBREVIATION	EXPLAINED	SUBJECT	PAGE REFERENCE
ISTE	1.5	Computational Thinker: Students develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methods to develop and test solutions.	Computer Science	39, 41, 44, 46, 49, 52
NCSS.D2	Civ.7.K-2	Apply civic virtues when participating in school settings.	Social Studies	191
NCSS.D2	Geo.7.3-5	Explain how cultural and environmental characteristics affect the distribution and movement of people, goods, and ideas.	Social Studies	197
NCSS.D2	Geo.7.6-8	Explain how changes in transportation and communication technology influence the spatial connections among human settlements and affect the diffusion of ideas and cultural practices.	Social Studies	188
NCSS.D2	His.12.6-8	Use questions generated about multiple historical sources to identify further areas of inquiry and additional sources.	Social Studies	185
NCSS.D2	His.13.6-8	Evaluate the relevancy and utility of a historical source based on information such as maker, date, place of origin, intended audience, and purpose.	Social Studies	185
NCSS.D2	Civ.4.9-12	Explain how the U.S. Constitution establishes a system of government that has powers, responsibilities, and limits that have changed over time and that are still contested.	Civics	193

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STANDARD	ABBREVIATION	EXPLAINED	SUBJECT	PAGE REFERENCE
NCSS.D2	Eco.2.9-12	Use marginal benefits and marginal costs to construct an argument for or against an approach or solution to an economic issue.	Economics	195
NCSS.D2	His.5.9-12	Analyze how historical contexts shaped and continue to shape people's perspectives.	History	66
NCSS.D2	His.6.9-12	Analyze the ways in which the perspectives of those writing history shaped the history that they produced.	History	66
NGSS	4-ESS2-2	Analyze and interpret data from maps to describe patterns of Earth's features.	Science	95
NGSS	4-PS3-2	Make observations to provide evidence that energy can be transferred by sound, light, heat, and electric currents.	Science	86
NGSS	MS-LS2-1	Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.	Life Science	99
NGSS	MS-LS2-2	Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.	Life Science	99
NGSS	MS-LS2-4	Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations	Life Science	99
NGSS	MS-LS4-4	Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.	Life Science	89

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STANDARD	ABBREVIATION	EXPLAINED	SUBJECT	PAGE REFERENCE
NGSS	MS-PS1-1	Develop models to describe the atomic composition of simple molecules and extended structures.	Physical Science	91
NGSS	HS-ESS1-5	Evaluate evidence of the movements of continental and oceanic crust to explain ages of crustal rocks.	Earth Science	96
NGSS	HS-LS1-3	Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.	Biology	88
NGSS	HS-PS2-1	Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.	Physics	64
NGSS	HS-PS2-2	Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when no net force acts on the system.	Physics	93

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Table of Examples, Lessons, and Units

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Preface

We live in an age where artificial intelligence (AI) is rapidly changing everything. Think about it: AI is already shaping how we shop, how we get our news, and even how doctors diagnose diseases. It's no exaggeration to say that AI is transforming every aspect of our lives, including education. For our students to thrive in this world, they need more than just the ability to use technology; they need to understand how it works, its potential, and its limitations. They need AI literacy. And the good news is, educators around the globe are recognizing this urgency. We're seeing a surge of initiatives aimed at integrating AI concepts into K–12 classrooms (UNESCO, 2022).

AI isn't just about technology; it's a fascinating blend of many different fields. Think philosophy, psychology, neuroscience, math—they all play a role in shaping how we build intelligent systems. And it's not a new idea either! Pioneers like Alan Turing (who gave us the famous Turing test to see if a machine could think like a human) and Frank Rosenblatt (who developed early neural networks, the foundation of today's machine learning) were already exploring these ideas back in the mid-20th century (Taylor & Dorin, 2020). Their work paved the way for large language models (LLMs) like GPT-4, a powerful model that can understand and generate human-like text. LLMs are already shaking up fields like education, offering incredible potential for personalized learning and creative applications. But with this potential come important questions. How will LLMs affect jobs? What are the ethical considerations we need to address? As AI keeps advancing, it's crucial that we learn to use it wisely and responsibly, ensuring it benefits humanity and creates a more equitable society. And that starts with bringing AI literacy into education.

So how do we actually bring AI literacy into our classrooms? That's where things get really interesting! This book dives deeply into the latest research and best practices for designing engaging lessons that integrate AI literacy into K–12 education. We'll explore everything from the Big Five Ideas in AI (Touretzky, Gardner-McCune, & Seehorn, 2023) to practical strategies for teaching AI core concepts across different subjects. You'll discover how to empower your students to not only understand AI but also to develop the critical thinking skills to

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evaluate its impact and use it ethically and responsibly. Imagine students designing their own AI projects, collaborating with their peers, and reflecting on the societal implications of AI! AI literacy has the potential to spark curiosity, boost critical thinking, and foster a love of lifelong learning, but it all comes down to how we, as educators, choose to integrate it. This book will help you navigate those choices and ensure your approach is thoughtful, intentional, and truly beneficial for your students.

Although this book doesn't delve into the technical intricacies of AI or its underlying mechanisms, we believe that by engaging with the book activities and adapting them to your own needs, you will begin your own AI literacy journey, gaining a deeper understanding of AI capabilities, limitations, and implications.

In writing this book, we have utilized Generative AI to support our creative writing process, ensuring our content is insightful and accessible. Generative AI has helped brainstorm ideas, refine our thoughts, and make sure our message is clear and engaging. This experience reinforced our belief in the power of AI tools to enhance creativity and learning. But more importantly, it reflects our commitment to walking the walk when it comes to AI integration. We hope this book serves as a valuable resource for teachers, teacher educators, curriculum developers, and researchers, offering practical strategies and insights to bring AI literacy into K–12 classrooms and empower a new generation of tech-savvy learners.

BOOK OVERVIEW

This book is divided into three parts, each designed to guide you as you explore how to integrate AI literacy into your teaching. Throughout the book you will also find different types of practical tools to support you in bringing AI literacy to your classroom, including:

- Examples that illustrate specific AI features and capabilities, provide resources for teaching and professional development
- Scenarios to engage in discussions around ethical considerations and potential biases in AI
- Lessons and instructional units aligned with discipline-specific educational standards that demonstrate ways to integrate AI concepts across various subjects
- Web resources that include templates, graphic organizers, and other teaching materials https://companion.corwin.com/courses/TeachingAILiteracy

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Part I provides educators with the theoretical foundations for integrating AI literacy into existing curricula, so that busy teachers don't feel like they have yet another subject to teach. We begin in Chapter 1 by exploring ethics and social justice issues related to AI literacy in education. We go on to discuss the current research about AI in K–12 education and introduce a new pedagogical framework for AI literacy that we developed (Chapter 2). This framework provides a structured approach for teachers to foster AI literacy in their students, guiding them to build foundational knowledge, apply AI concepts to real-world problems, and cultivate ethical awareness in the responsible use of AI. In Chapter 3, we delve deeper into how this framework can be put into practice, providing concrete examples and illustrating how it supports the development of students' cognitive, social-emotional, and technological skills. Finally, in Chapter 4 we offer practical recommendations for educators to prepare for integrating AI literacy into their curricula.

Part II shifts from theory to practice, providing concrete examples and strategies for integrating AI literacy into your existing curriculum. In Chapters 5 through 8 we delve into specific core disciplines—Science, Mathematics, English Language Arts, and Social Studies—offering guidance and examples for different grade bands. When appropriate advocate for using AI tools that allow students to actively explore the Five Big Ideas in AI: perception, representation and reasoning, learning, natural interaction, and societal impact (Touretzky et al., 2023). To deepen understanding, we draw parallels between how AI systems function and the process of human learning, demonstrating how concepts like data processing, decision making, and feedback loops can be mirrored in engaging classroom activities. Throughout these chapters, we emphasize a thoughtful and purposeful approach to AI integration. This means carefully considering learning outcomes, within the specific discipline and in terms of AI literacy, and designing student experiences that foster meaningful connections. We also provide guidance on navigating potential challenges and ensuring that technology is used effectively to enhance learning.

Finally in **Part III**, in Chapter 9 we provide a brief overview of the current research on assessment in AI literacy, introducing an Assessment of AI Literacy Framework for evaluating students' understanding and offering examples of assessment tools that can be adapted for K–12 classrooms. We conclude the book with discussion of possible ways AI can transform teaching and learning in the future.

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HOW TO USE THIS BOOK

- *Understand the landscape*: Begin with Chapter 1 to gain a broad understanding of global perspectives in AI literacy education, including important considerations like ethical issues, equity and access, cultural and social impacts, and curriculum design.
- *Adopt the pedagogical framework for AI literacy*: Embrace the *design–create–reflect* (DCR) process introduced in Chapter 2 as a foundational approach to integrating AI literacy. This framework promotes active learning, critical thinking, and creative application.
- *Examine effective practices*: Study the examples presented in Chapter 3 to understand how the pedagogical framework can be applied in real-world classrooms aiding students in developing cognitive, social-emotional, and technological skills related to AI.
- *Prepare for integration of AI literacy*: Use Chapter 4 to identify strategies for equipping yourself to integrate AI literacy into curricula, including professional development opportunities and resources.
- *Explore diverse examples*: Dive into Chapters 5 through 8 to discover practical strategies for integrating AI literacy across various grade bands and subjects, with examples illustrating how AI concepts connect to specific disciplinary standards and learning objectives.
- *Assess AI literacy*: Explore and adapt the assessment resources suggested in Chapter 9 to evaluate student progress in AI literacy. These resources can help you measure students' understanding of AI concepts and their ability to apply them creatively.
- *Adapt to your context*: Tailor the strategies and examples in this book to fit your school's or district's specific needs and resources, creating a customized approach to AI literacy education.

By embracing the integration of AI literacy in your teaching, you are not only equipping students with essential skills for the future but also empowering them to become informed and ethical users of this transformative technology. Ultimately, you are the key to fostering AI literacy in your students.

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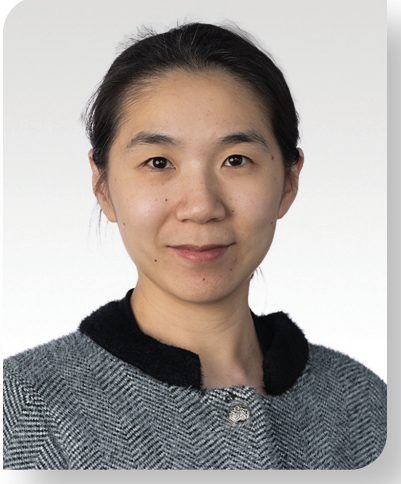
About the Authors

Source: Robert Davidson

Dr. Irina Lyublinskaya is a Professor of Mathematics and Education at Teachers College, Columbia University, New York. She holds PhD in Theoretical and Mathematical Physics from the Leningrad State University, Russia. She taught high school and university mathematics and science for more than 35 years. She is a recipient of various awards, including Radioshack/Tandy Prize for Teaching Excellence in Mathematics, Science, and Computer Science; NSTA Distinguished Science Teaching Award and citation; Education's Unsung Heroes Award for innovation in the classroom; and NSTA Vernier Technology Award. Her research interests are in the areas of STEM education, teacher education, curriculum development, and international comparative education. She authored/co-authored 22 books, 15 book chapters, and more than 100 peer-reviewed papers and proceedings in these fields.



Dr. Xiaoxue Du is the Senior Director of AI Strategy and Operations at the University of Chicago, with a track record of leading digital transformations and driving strategic initiatives across industries. With a deep commitment to advancing AI literacy, she has developed curricula and resources to help K–12 educators integrate AI concepts into classrooms in engaging and responsible ways. Her work

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spans AI-enriched learning experiences, game-based AI education, and ethical AI adoption in schools. Previously, she collaborated with the MIT Media Lab on research and teaching in AI literacy and human–AI interaction and worked with a top consulting firm, where she specialized in AI strategy, digital transformation, and operational excellence. Dr. Du actively writes and teaches about human–AI interaction, focusing on preparing the next generation of learners and educators to navigate an AI-driven world. She holds a doctorate from Teachers College, Columbia University, where she conducted mixed-methods research to study complex sociotechnical systems.

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PART I

Theoretical Foundations

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CHAPTER 1

Ethics and Global Perspectives on AI Literacy Education

The rapid integration of artificial intelligence (AI) in education has raised important ethical concerns, emphasizing the need for AI literacy to ensure that these technologies are used responsibly and equitably. As AI becomes more prevalent in classrooms, it has the potential to enhance learning experiences and exacerbate existing inequalities if not carefully implemented. Teachers and students alike must be equipped with the skills to critically engage with AI, ensuring that it supports fair and transparent learning environments for all. Globally, AI literacy education takes on various forms, shaped by regional priorities, resources, and cultural contexts. However, several common themes emerge across different regions: the importance of addressing bias and discrimination in AI, the need for privacy and data security, ensuring transparency in AI decision making, closing the Digital Divide, and preparing teachers and students for the AI-driven future (Casal-Otero et al., 2023). This chapter explores ethical issues and examines how AI literacy education is being approached across the globe, with a focus on K–12 education (Sperling et al., 2024).

ETHICS AND EDUCATION

AI literacy education is essential in addressing the ethical issues that arise from the increasing integration of AI in education. The increasing presence of AI in classrooms comes with critical concerns, such as algorithmic bias, privacy violations, and accountability in decision making. These concerns have real-world implications for educational practices and student outcomes. Teachers must understand how AI operates, not just from a technical standpoint but also in terms of its societal and ethical consequences. AI literacy can empower teachers and students to critically engage with technology, giving everyone the tools to

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evaluate the benefits and risks of AI. In doing so, students and teachers alike develop the ability to critically evaluate AI applications, discern potential biases, and understand the broader societal implications of their use. With these abilities they are empowered to make informed decisions that prioritize ethical considerations alongside technological advancements. As the global landscape evolves toward an AI-driven future, equipping students and teachers with these essential skills ensures they can navigate not only the technical complexities but also the ethical challenges inherent in this new reality. Let's examine these ethical issues in more depth.

BIAS AND DISCRIMINATION

As you might already know, AI algorithms are often trained on historical data, which can carry biases that reflect societal inequalities. As a result, AI algorithms can perpetuate existing biases in data, leading to discriminatory outcomes in areas like admissions, grading, and personalized learning. An AI-driven grading tool, for example, could unfairly favor students from backgrounds that are overrepresented in its training data, while disadvantaging those who don't fit these patterns. Similarly, in admissions processes, AI systems designed to predict student success might disproportionately favor applicants from schools or regions that historically perform well, which could be influenced by access to better resources, socioeconomic status, or geographic location. This bias could lead to the system undervaluing students who are equally capable and from underrepresented backgrounds or schools with fewer resources. These subtle (and sometimes not so subtle!) forms of bias in AI-driven educational tools can perpetuate inequalities, reinforcing stereotypes, and creating barriers to success for those already marginalized in the system.

Scenario 1.1

Imagine you're a teacher grading two essays on the same topic.

- Essay A: Written by a student who consistently participates in class, asks thoughtful questions, and turns in assignments on time. The essay is well written but has a few minor grammatical errors.
- Essay B: Written by a student who is often quiet in class, rarely participates, and has missed a few deadlines. The essay is also well written, with similar content quality to Essay A, but has a few more grammatical errors.

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Questions:

- How would you grade these two essays?
- Would you give them the same grade or different grades?
- If different, which one would receive the higher grade?

Just as teachers can unconsciously favor students based on preexisting impressions, AI systems can exhibit bias due to skewed training data or flawed algorithms. In both cases, seemingly objective evaluations can be influenced by factors unrelated to actual performance. The **halo effect** in grading parallels AI's tendency to generalize based on limited data, whereas **confirmation bias** reflects AI's potential to reinforce existing patterns. Recognizing and addressing these biases is crucial for ensuring human and machine assessments are fair, accurate, and equitable.

- The **halo effect** is a type of cognitive bias where our overall impression of a person influences how we feel and think about their specific traits.
- **Confirmation bias** is the tendency to search for, interpret, favor, and recall information in a way that confirms or strengthens our preexisting beliefs or values.

PRIVACY AND DATA SECURITY

The collection and use of student data raise concerns about privacy breaches and misuse of sensitive information. As AI systems in education increasingly rely on collecting data—from demographic information to behavioral patterns and even health-related metrics—protecting student privacy becomes a crucial ethical issue. Without appropriate safeguards, this data could be exposed to misuse, breaches, or exploitation, putting the security and dignity of students at risk. A relevant example can be seen in the use of AI-powered health-monitoring tools in schools. Some schools have adopted wearable devices that track students' physical activity, sleep patterns, and heart rates to promote health and well-being.

Although these tools can provide valuable insights into student wellness and support health interventions, they also collect highly sensitive biometric data. If this data is not adequately protected, it could fall into the wrong hands or be used for purposes beyond the original intent, such as insurance companies accessing student health records or unauthorized third parties using it for commercial purposes.

Scenario 1.2

Your school decided to use an AI-powered learning platform that tracks student progress and behavior. It collects data like how long students spend on each task, which questions they struggle with, and even their emotional state based on facial expressions during online lessons.

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REFLECTION QUESTIONS

- What potential benefits and challenges do you see in using such an AI-powered learning platform in your classroom?
- How comfortable would you feel with this level of student data collection? What concerns do you have about student privacy and data security in this scenario?
- Do you think there are any ethical implications of using AI to track student emotions during online lessons? How might this impact the student–teacher relationship or the overall learning environment?

Although this data can help teachers personalize instruction and identify students who need extra support, it's highly sensitive. If this data were accidentally shared publicly or accessed by unauthorized individuals, it could reveal private details about students' learning difficulties, emotional struggles, or even their home environment (based on background noise during online classes). This not only violates student privacy but could also lead to stigma, bullying, or discrimination.

Even with the best intentions, using AI tools in the classroom requires careful consideration of data privacy. Teachers need to be aware of what data is being collected, how it's being used and stored, and who has access to it. Open communication with students and parents about data practices is essential to build trust and ensure ethical use of AI in education.

ACCOUNTABILITY AND TRANSPARENCY

A major challenge in AI use in education is the lack of transparency in how AI systems make decisions. AI algorithms often operate as "black boxes," where the internal processes that lead to specific outcomes are difficult to understand. This lack of transparency makes it hard to identify potential biases or errors, particularly in education, where fairness and equity are paramount. When decisions affecting students' futures—such as admissions, grading, or placement in advanced courses—are influenced by AI, the absence of clear decision-making processes can erode trust and accountability. For example, in many schools, AI-powered systems are being used to recommend students for so-called gifted programs or advanced placement courses. These systems often rely on a mix of student performance data, standardized test scores, and behavioral metrics.

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Scenario 1.3

Your school is facing increasing pressure to more effectively identify and support students who are high achievers. The current identification process, relying heavily on teacher recommendations and standardized tests, has been criticized for its subjectivity and potential biases. The school district is considering adopting an AI-powered placement system to streamline the process and ensure a fairer, more data-driven approach.

A committee of teachers, administrators, and parents has been formed to evaluate several vendor proposals. As a member of this committee, you are tasked with scrutinizing the AI systems and asking probing questions to ensure the chosen system aligns with the district's values and priorities. You understand the potential benefits of AI but also recognize the need for careful consideration and ethical implementation. What questions will you ask the vendors to address concerning transparency, fairness, data privacy, and the impact on students and teachers?

If teachers, students, and parents don't fully understand how student metrics are weighted and combined, students from underrepresented groups or those who don't perform well on standardized tests may be overlooked, even if they possess the potential to excel in advanced courses. Without transparency, it's nearly impossible to ensure that the AI system is not reinforcing existing biases, such as favoring students from more privileged backgrounds who have better access to test preparation resources. A transparent AI system would allow educators to review and adjust the criteria to ensure fair and inclusive decision making for all students.

REFLECTION QUESTIONS

- How does your AI system make decisions about student placement? Can you provide clear explanations for the factors considered and how they are weighted in the decision-making process?
- What specific student data is collected and how is it used? What safeguards are in place to protect student data privacy and security?
- How does your system incorporate teacher input and observations, and how does it empower students in the placement process? What evidence do you have that your system is effective in identifying students who are high achievers and improving their educational outcomes?

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DIGITAL DIVIDE: ACCESSIBILITY ACROSS DISCIPLINES

The Digital Divide goes far beyond simply providing access to technology (Chang et al., 2014); it's about ensuring every student can engage meaningfully with technology. Achieving equity in AI literacy education requires a multifaceted approach—from motivating students to offering accessible materials across disciplines (Roshanaei et al., 2023). As educators, we have a crucial role in advocating for and implementing solutions that address these challenges, ensuring that all students have the tools, skills, and encouragement they need to thrive in an AI-driven world (Kong et al., 2024). To prepare students for the challenges of the future, AI literacy should be integrated across curriculum to broaden access, not just within science, technology, engineering, and mathematics (STEM) disciplines (Cantú-Ortiz et al., 2020).

In this book we provide multiple examples of how AI literacy can be integrated with various school disciplines such as social studies, English Language Arts (ELA), science, and mathematics. For instance, a middle school science unit on ecosystems (Chapter 5) allows students to explore different types of datasets, learning how choices in data labeling and dataset construction influence how computers learn. In an ELA example (Chapter 7), students examine themes of power, creation, and creators in literary texts, drawing connections between these literary concepts and the use of AI for social good. This approach makes AI concepts more tangible for students and teachers and illustrates the pervasive influence of technology, fostering a comprehensive understanding of AI's broader implications.

STUDENT AUTONOMY AND AGENCY

AI systems that track and monitor students' activities excessively can significantly limit their autonomy and sense of control over their learning. Although these technologies are often designed to personalize learning experiences and provide targeted support, there is a risk that they can undermine students' ability to make independent decisions about their education. When AI platforms constantly track student progress, suggest learning paths, or even intervene in task selection, students may feel like they are merely following instructions rather than actively participating in their learning journey. As an example, AI systems that monitor students' engagement in online classrooms often track metrics like time spent on tasks, frequency of clicks, or even facial expressions during virtual lessons. These systems may flag students who are perceived as "disengaged" or "distracted" based on these data points, prompting teachers to intervene.

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Scenario 1.4

You're a high school teacher using an AI-powered online learning platform that monitors student engagement during virtual lessons. One day, the system repeatedly flags a particular student, Sarah, for appearing disengaged. However, you know Sarah to be a bright and capable student who actively participates in class discussions and consistently submits high-quality work. You're faced with a dilemma:

- Trust the AI: The AI system is flagging Sarah as disengaged, suggesting she might need additional support or intervention. Perhaps there's something going on that you're not aware of, and the AI is picking up on subtle cues.
- Trust your own judgment: You know Sarah to be a good student, and you haven't observed any signs of disengagement during class. You're concerned that the AI might be misinterpreting her facial expressions or that there might be other factors influencing her behavior that the AI isn't considering.

REFLECTION QUESTIONS

- How do you balance the AI's data-driven insights with your own observations and knowledge of the student?
- Should you intervene with Sarah based solely on the AI's flags, or should you gather more information first?
- How can you ensure that the use of AI in the classroom doesn't create a climate of surveillance and anxiety for students?
- What are the potential consequences of overrelying on AI to monitor student engagement, and how can these be mitigated?

Although such systems aim to enhance learning outcomes by identifying students who might need additional support, they can also contribute to feelings of surveillance, reducing students' sense of privacy and autonomy. When students feel that every movement or moment of inattention is being tracked and judged, they may become more focused on meeting the system's engagement criteria rather than genuinely engaging with the content.

CULTURAL SENSITIVITY AND DIVERSITY

AI systems can struggle to understand and respond to diverse cultural contexts, potentially reinforcing stereotypes or marginalizing certain groups (Southworth et al., 2023). Careful design

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and inclusive datasets are crucial to mitigate this risk. This is particularly concerning in environments like classrooms, where students come from a wide range of cultural backgrounds, and it is critical that all students feel seen, heard, and valued.

Scenario 1.5

You're a middle school English teacher using an AI-powered chatbot to help students practice their conversational skills and vocabulary. You notice that when some of your students, who are English Language Learners, interact with the chatbot, it frequently misunderstands their phrasing or cultural references. This leads to frustrating conversations where the chatbot gives irrelevant or even insensitive responses, making these students feel excluded and discouraged from participating.

REFLECTION QUESTIONS

- How can you address the cultural insensitivity of the AI chatbot and create a more inclusive learning environment for all your students?
- Should you continue using the chatbot despite its limitations, or should you explore alternative tools that are more culturally sensitive?
- How can you leverage this experience to teach your students about the potential biases in AI and the importance of creating technology that is inclusive and respectful of diverse cultures?
- What steps can you take to advocate for more culturally responsive AI tools in education and ensure that all students have equal access to the benefits of technology.

Writing styles, argument structures, and even the use of metaphors or examples can vary greatly across cultures. An AI system that is not designed with this diversity in mind might penalize students for using unfamiliar rhetorical strategies, even if their reasoning and creativity are strong. This reinforces a narrow view of what constitutes "good" academic performance, which may privilege some students over others.

These interconnected challenges demand a multifaceted approach to ensure that AI technology serves as a force for good in education, fostering equitable access, promoting ethical practices, and empowering all learners to thrive. Having examined a range of critical ethical considerations in education, we are now ready to reflect on the broader implications of these issues.

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REFLECTION QUESTIONS

- How can we, as educators, proactively identify and address biases in AI systems to ensure equitable learning experiences for all students?
- What level of transparency is necessary for students and parents to feel comfortable with the use of AI in their educational journey?
- How do we avoid overreliance on AI and empower students to take ownership of their learning?
- Recognizing that AI systems may lack cultural sensitivity, how can we proactively select and implement AI tools that are inclusive and respectful of diverse cultures?

GLOBAL PERSPECTIVES ON AI LITERACY EDUCATION

Global perspectives on AI literacy education emphasize a shared understanding that AI is fundamentally shaping the future, making it essential for students worldwide to grasp its implications. Therefore, it is our responsibility as educators to equip students with the knowledge and skills necessary to navigate an increasingly AI-driven world. By fostering critical thinking, ethical awareness, and responsible AI use, AI literacy empowers students to engage thoughtfully with these technologies, preparing them to make informed decisions and contribute to a more equitable and just society in the face of rapid technological advancements.

As the world embraces the integration of AI, four key perspectives emerge, each shaping the trajectory of AI literacy education: the recognition of AI's growing impact, the emphasis on foundational skills, the importance of teacher training, and the pursuit of equity and inclusion. Let's consider each of these perspectives in more detail.

THE RECOGNITION OF AI'S GROWING IMPACT

The transformative nature of AI is universally acknowledged, and countries across the world are incorporating AI literacy into their educational frameworks to prepare students for an AI-driven future. Students must not only understand AI technologies but also recognize their societal and ethical implications.

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The goal of education is to foster a generation that can think critically about AI's role in decision making, innovation, and governance.

EXAMPLE 1.1

Use of AI in Surgery

AI is increasingly being used to make decisions in health care, finance, and law. In surgery, AI is being used in a variety of ways to enhance precision, efficiency, and patient outcomes.

FIGURE 1.1 ● Robotic surgery room

Source: istock.com/PhonlamaiPhoto

Students who understand the underlying mechanisms of AI and its potential biases are better equipped to challenge unjust outcomes and offer innovative solutions. AI literacy education helps students recognize that AI technologies can empower and limit decision-making processes, depending on how they are designed and deployed. As such, a critical understanding of AI's impact is essential for students to navigate and influence the future of AI development and its societal integration.

THE EMPHASIS ON FOUNDATIONAL SKILLS IN AI LITERACY

At the core of AI literacy education is the development of foundational skills, particularly in STEM. These skills enable students to not only use AI technologies but also to understand how they

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function, how to design them, and how to critically evaluate their applications. Foundational skills in programming, data analysis, and problem solving are crucial for students to move beyond being passive users of AI and instead become active creators and thinkers who can improve and innovate within the field.

EXAMPLE 1.2

Developing Programming Skills in Elementary Education

Students can develop computational thinking through robotics, coding, and basic programming as early as primary school.

FIGURE 1.2 ● Coding robots in elementary school

Source: Source: istock.com/insta_photos

Computational thinking teaches students to break down complex problems into smaller, manageable parts, which is a core concept in developing AI algorithms. Moreover, these foundational skills help students engage with AI technologies from a multidisciplinary perspective, connecting the technical aspects of AI with real-world applications across various fields such as environmental science, social justice, or economics.

THE IMPORTANCE OF TEACHER TRAINING TO ACHIEVE SUCCESS IN AI LITERACY

Teachers are central to the success of AI literacy education. We are the ones who introduce students to AI concepts, guide ethical discussions, and help students apply AI to real-world

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problems. However, teaching AI literacy requires a specific set of skills and knowledge that many of us as educators may not yet possess. This creates a global need for professional development and training that equips teachers with the technical expertise and the pedagogical strategies to integrate AI literacy into their classrooms. Teacher training in AI literacy must go beyond the basics of how AI technologies work. It should also cover the ethical implications of AI, so that teachers can facilitate meaningful discussions with students about these issues. As teachers we need to understand not only the mechanics of AI but also how to frame AI as a tool that can either support or undermine equity and justice, depending on how it is used. Additionally, teachers must be prepared to guide students in applying AI concepts to solve real-world problems, making the learning experience practical and impactful. In Chapter 4 we include research-based recommendations and resources to help you prepare for integration of AI literacy into your curriculum.

THE PURSUIT OF EQUITY AND INCLUSION IN AI LITERACY

A central challenge in AI literacy education is ensuring that it is accessible and inclusive for all students, regardless of their socioeconomic background or geographic location. AI has the potential to exacerbate existing inequities if equity is not addressed properly. Therefore, a global focus on equity in AI literacy education aims to bridge the Digital Divide and ensure that AI literacy does not become a privilege reserved for a few. Efforts to promote equity and inclusion in AI literacy education involve providing students with access to the necessary tools and resources, ensuring diverse representation in AI datasets, and encouraging the development of culturally responsive AI systems.

EXAMPLE 1.3

Access to Virtual Learning

In situations where financial constraints or geographic barriers prevent students from learning specific courses, AI-powered educational platforms can step in to bridge the gap. These platforms, equipped with vast libraries of knowledge and interactive learning

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tools, essentially act as virtual teachers, offering students the opportunity to explore subjects and gain valuable skills, regardless of their circumstances. AI-powered educational platforms can provide students with step-by-step tutorials and interactive simulations, guiding their explorations of topics that are not accessible to them in schools. These platforms could also connect students with online communities where they can ask questions, share their projects, and learn from others with similar interests.

FIGURE 1.3 ● A middle school student learning electronics virtually

Source: istock.com/ KarlosVBrito7

By fostering an inclusive approach to AI literacy, educators can ensure that all students, especially those from communities that are historically and currently underserved, are empowered to engage with AI technologies in ways that benefit their personal and professional development. Equity in AI literacy also involves preparing students to critically assess how AI systems affect different communities. This includes teaching students to question who designs AI systems, whose voices are included in decision-making processes, and who is affected by the outcomes. An inclusive AI literacy curriculum encourages students to think about how AI can be used to promote social good and ensure that technological advancements benefit everyone, not just the privileged few.

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REFLECTION QUESTIONS

- How can I proactively adapt my teaching practices to incorporate AI tools and resources, ensuring that my students develop the digital literacy skills necessary for the future?
- In what ways can I foster critical thinking, problem solving, and creativity in my students, ensuring that they are equipped to navigate a world increasingly shaped by AI?
- How can I collaborate with my colleagues to share best practices and explore innovative ways to leverage AI in our teaching?
- What strategies can I employ to create an inclusive learning environment that celebrates diversity and empowers all learners to succeed in an AI-powered world?

Chapter Summary

The importance of AI literacy extends far beyond mastering technical skills; it provides a crucial foundation for addressing the ethical challenges posed by AI integration into society. As AI systems increasingly influence decisions in areas such as healthcare, criminal justice, and employment, it becomes vital to teach students how to critically assess the ethical implications of these technologies. Making AI literacy accessible and inclusive ensures that all students understand the societal impacts of AI, particularly how biases can be embedded and perpetuated if systems are not designed and implemented responsibly. This chapter underscores that confronting these ethical challenges requires a global educational approach that adapts to regional contexts and perspectives.

AI's rapid transformation of the educational landscape makes the urgency to integrate AI literacy into curricula and pedagogy more pressing than ever (Lee et al., 2021). However, despite its evolving presence, there is still a notable gap in research and resources for AI literacy education (Micheuz, 2020; Yue et al., 2021). This poses a significant challenge for educators, who need to acquire the necessary knowledge and skills to effectively introduce AI concepts into their classrooms (Touretzky et al., 2019). Some countries, recognizing this need, have already made efforts in promoting AI literacy in K–12 education, creating comprehensive AI curricula that address technical

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proficiency and ethical considerations. However, to truly meet the global challenge, more efforts are needed to ensure development of educational frameworks that are adaptable to diverse cultural and regional needs.

Although the foundations of AI literacy may be universal, its application is not one size fits all. Regional variations in priorities, resources, and cultural contexts require tailored approaches to ensure that AI literacy education is relevant and effective across different settings. Teachers play a pivotal role in this process, guiding students through not only the technical aspects of AI but also its ethical and societal implications. As we move forward, the responsibility lies with educators to ensure that students are equipped with the critical thinking skills and ethical awareness necessary to navigate an AI-driven world responsibly and inclusively.

Wrap-Up Questions

- As AI becomes increasingly integrated into education, what are some key ethical considerations we must address to ensure responsible and equitable use of these technologies, for example,
  - How can we protect student data and privacy in an AI-powered learning environment?
  - How can we ensure that AI algorithms used in education are transparent, fair, and free from bias?
- How can we foster cross-cultural understanding and collaboration in an AI-powered world, ensuring that diverse perspectives are valued and respected?
- How can we leverage AI to address global educational challenges, such as access to quality education in underserved communities?
- How can we prepare students to be responsible global citizens who can navigate the ethical complexities of AI in a rapidly changing world?

The questions that we asked throughout this chapter, though challenging, are crucial stepping stones on the path to responsible and informed AI literacy education. We don't expect you to provide immediate answers; rather, we hope this initial exploration has sparked curiosity and a desire for deeper understanding. As we progress through the book, we delve into these ethical dilemmas, global perspectives, and their implications for teaching and learning about AI. Together, let's navigate the complexities and opportunities that lie ahead.

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