

Level Up AI

*Game-Based Learning for AI Literacy in a
Complex World*

by

Xiaoxue Du and Zhichun Liu

Level Up AI: Game-Based Learning for AI Literacy in a Complex World

by Xiaoxue Du and Zhichun Liu

2026

Ethics International Press, UK

British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library

Copyright © 2026 by Xiaoxue Du and Zhichun Liu

All rights for this book reserved. No part of this book may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior permission of the copyright owner.

ISBN (Hardback): 978-1-83711-577-8

ISBN (Ebook): 978-1-83711-578-5

Contents

List of Tables.....	viii
Preface What This Book Is For.....	xi
Book Overview	xiii

Part I: Preparing Teachers to Design AI-Literacy Learning

Chapter 1: Preparing Teachers to Design for AI Literacy	1
The Answer That Sounded Right.....	1
Introduction	2
AI Literacy Is an Emerging Field	4
Teachers as Designers of AI-Literacy Learning.....	8
Designing for Critical AI Literacy	9
Supporting Teachers to Develop AI Literacy.....	14
Classroom Resources	15
References.....	19
Chapter 2: Why Game-Based Learning? Teaching AI Literacy Through Systems, Decisions, and Play	24
The Second Envelope.....	24
Introduction	25
Game-Based Learning.....	25

Teachers Learning Through Game-Based Learning Principles ...	28
Why It Matters for AI Literacy	29
A Developmental Progression Across K–12.....	38
Limitations and Guardrails.....	40
Classroom Resources.....	41
References	42
Chapter 3: Integrating Game-Based Learning Through Design–Create–Reflect	48
Starting with the Decision.....	48
Introduction	49
The DCR Framework.....	50
A Teacher Planning Model for DCR Game-Based Lessons.....	60
Practical Principles for Designing DCR Game-Based Learning Lessons.....	63
Classroom Resources.....	84
References	85

Part II: Designing Game-Based Learning Across the Disciplines

Chapter 4: Connecting DCR Game-Based Learning to Disciplinary Practice.....	93
When the Standard Comes After the Game	93
Why Disciplinary Alignment Matters	94
AI Literacy and Digital Learning Across Disciplines.....	133
Planning with UbD, UDL, and DCR	150

Classroom Resources	158
Further Reading.....	159
Chapter 5: Color Conquest as a Design–Create–Reflect Lesson	161
The Move That Did Not Make Sense.....	161
Introduction	161
Color Conquest Through the DCR Framework	163
A Teacher Planning Model for Color Conquest Using Understanding by Design	169
Classroom Resources	190
References.....	191
Chapter 6: AI Frontier as a Design–Create–Reflect Lesson.....	192
What the Dashboard Did Not Show.....	192
Introduction	193
AI Frontier Through the DCR Framework	193
A Teacher Planning Model for AI Frontier Using Understanding by Design	201
Classroom Resources	218
References.....	219
Conclusion.....	221
Appendix A: Glossary of Key Terms	223

List of Tables

Table 1.1 Core Components of the Design–Create–Reflect (DCR) Framework.....	4
Table 2.1 Developmental Progression for Game-Based AI Literacy	20
Table 3.1 Adapted from the Summary of Competencies, Learning Outcomes, and Theoretical Basis for Our Pedagogical Framework for AI Literacy (Lyublinskaya & Du, 2025).....	26
Table 3.2 A Compact DCR Lesson Architecture Integrating DCR Competencies and Game-Based Learning Strategies.....	30
Table 3.3 Teacher Facilitation Guide.....	31
Table 3.4 Student Activity Guide: Design a Bus Network.....	33
Table 3.5 Student Activity Guide: Build and Test a Reliability Rule	36
Table 3.6 Student Activity Guide: Improve a Water-Filter Design	37
Table 3.7 Student Activity Guide: Review a Social Media Feed ..	38
Table 3.8 Student Activity Guide: Color Conquest Team Challenge.....	39
Table 3.9 Teacher Debrief Guide: Storytelling Village.....	40
Table 3.10 Student Activity Guide: Investigate Plant Growth	41
Table 4.1 Disciplinary and AI-Literacy Frameworks Used in This Book	47
Table 4.2 English Language Arts Strands Through DCR.....	49
Table 4.3 English Language Arts Clusters, Classroom Scenarios, and Evidence.....	50

Table 4.4 Mathematics Domains and Practices Through DCR....	53
Table 4.5 Mathematics Standards, Color Conquest Scenarios, and Evidence.....	55
Table 4.6 The C3 Inquiry Arc Through DCR	57
Table 4.7 C3 Components, AI Frontier Scenarios, and Evidence	59
Table 4.8 NGSS Dimensions Through DCR.....	61
Table 4.9 NGSS Components, Game-Based Scenarios, and Evidence.....	63
Table 4.10 The AI4K12 Five Big Ideas Through DCR.....	65
Table 4.11 Selected AI4K12 Subconcepts, Game Scenarios, and Evidence.....	67
Table 4.12 Selected ISTE Standards Through DCR.....	69
Table 4.13 Selected ISTE Indicators, Game Scenarios, and Evidence.....	70
Table 4.14 The Roles of UbD, UDL, and DCR	73
Table 4.15 UbD Planning Bridge for AI Literacy and Game-Based Learning.....	74
Table 5.1 Color Conquest Game Elements and DCR Competencies.....	78
Table 5.2 Stage 1: Desired Results	82
Table 5.3 Stage 2: Assessment Evidence	85
Table 5.4 Stage 3: Expanded Learning Plan for Color Conquest.	87
Table 6.1 AI Frontier Game Elements and DCR Competencies ..	91
Table 6.2 Stage 1: Desired Results	95
Table 6.3 Stage 2: Assessment Evidence	97
Table 6.4 Stage 3: Expanded Learning Plan for AI Frontier.....	99

Preface

What This Book Is For

With the development of AI technologies, teachers are uniquely positioned to design inquiry-based learning environments that give students agency. Within this environment, students can develop reasoning and problem-solving skills while building core skills for their future careers.

Starting with Part I, we will introduce the core principles through game-based learning and pedagogical design through the Design–Create–Reflect (DCR) framework. Teachers take a game-based learning approach to apply the concept of AI literacy into curriculum planning, which gives students agency to make decisions, see how a system responds, correct misconceptions, and question the rules themselves. In Part II, there are two examples showcasing how to apply game-based learning into the Design–Create–Reflect (DCR) framework, in classroom teaching along with the specified lessons ready for facilitated classroom playtesting.

DCR operates at two connected levels: teachers use it to design the learning environment, while students experience it as a recurring process of framing, testing, interpreting, and revising.

Table 1.1. Core Components of the Design–Create–Reflect (DCR) Framework

<i>DCR phase</i>	Teacher planning role	Student learning activity
Design	Frame the problem, identify the intended understanding, anticipate learner needs, and make goals, stakeholders, information, assumptions, and constraints visible.	Examine the situation, identify who is involved, define the problem, question the available information, and develop an initial plan or prediction.
Create	Design a consequential task in which student decisions produce visible results and usable evidence.	Build, play, calculate, test, compare, record results, and revise a strategy or artifact.
Reflect	Plan prompts and assessments that support explanation, ethical reasoning, revision, and transfer.	Interpret the evidence, explain what happened, consider who benefited or was overlooked, revise the response, and apply the learning elsewhere.

A note on the use of generative AI. In preparing this book, the author used generative-AI tools to assist with editing and formatting, with drafting and refining prose and tables from the author’s outlines and source material, and with standardizing citations and cross-references. The author directed all such use, reviewed and verified the content against primary sources, and takes full responsibility for the accuracy, originality, and integrity of the work. No AI tool is credited as an author. The Design–Create–Reflect framework, the games, and the ideas in this book are the author’s own.

Book Overview

AI shapes much of a young learner's day. It recommends what they watch, completes their sentences, filters what they see, and increasingly influences what they learn. Students use these systems before they understand how the systems make choices, or that choices have been made at all.

This book starts from the premise that teachers are the designers in the classroom. Teachers have unique opportunities to design unique environments for developing students' ability to ask how a system represents the world, what it is built to optimize, what it leaves out, who benefits, and who could change it. Students can make decisions, see consequences, reflect their thinking, and decide what they would do next.

Part I, comprising the first three chapters, establishes the learning-science foundations of the Design–Create–Reflect (DCR) framework. These chapters explain how teachers can design learning environments that help students develop agency. Design phase asks teachers to identify the learners, goals, values, and constraints that should shape the learning experience. Create phase asks teachers to build activities and environments in which students can make meaningful choices, test strategies, and experience the consequences of their decisions. Reflect asks teachers to help students interpret those consequences, consider who was served or overlooked, and revise both their decisions and the systems in which those decisions were made.

Part II, comprising Chapters 4 through 6, shows how teachers can apply the DCR framework to design game-based learning experiences across different disciplinary and social contexts. Chapter 4 connects the framework to disciplinary standards and shows how to plan a standards-aligned game-based lesson. Chapter 5, *Color Conquest*, demonstrates how teachers can help students examine why a mathematical model may be technically accurate yet fail to reflect what a community values. Chapter 6, *AI Frontier* illustrates how teachers can create a simulated social environment in which students navigate tensions among access, quality, organizational survival, worker well-being, and platform visibility.

The chapters walk teachers through identifying what students need to understand, aligning content with relevant learning standards, defining clear learning goals, designing lesson activities that support students' decision-making and reflection, and developing formative assessments that make students' learning visible. Together, the chapters offer reusable models that teachers can use to design, test, and refine AI-literacy learning experiences in their own classrooms.

Part I:
Preparing Teachers to Design
AI-Literacy Learning

Chapter 1

Preparing Teachers to Design for AI Literacy

The Answer That Sounded Right

Ms. Alvarez had asked the class to write a short account of a housing dispute in their city. Jordan used an AI tool to help sort through his notes. When he read the result aloud, it said the families had been moved because the buildings were unsafe. The paragraph sounded reasonable. It was clear, organized, and more finished than most of the drafts students had written on their own. Elena was the first to question it. “Was that the only reason?” Ms. Alvarez asked everyone to look at the documents again. Safety did come up, but there was more to the dispute. The class took more ownership to find references to develop arguments over relocation and residents who had been organizing for years. Ms. Alvarez changed course. She asked the class what the paragraph had included, what it had missed, and whose version of the story they were hearing. Jordan rewrote the paragraph before class ended. The new version gave the residents a place in the story.

This moment connects to the main idea in Chapter 1. AI literacy is about knowing when an answer needs to be questioned. Jordan’s paragraph sounded finished, but the class found that it told only part of the story. By returning to the documents, students could see what had been left out and whose role had been reduced. Ms. Alvarez treated it as in-progress work for the classroom to learn together. This sequence introduces the central movement of DCR:

frame the problem, test a response, and reconsider it in light of evidence.

Introduction

In today's classrooms, technology is everywhere. Teachers use all sorts of digital tools—maybe to organize lesson plans, give examples, tweak reading assignments, make quizzes, or give feedback. There are also online systems that provide reports showing which students might need extra help or which learning resources to try next, and they often summarize how students are progressing. These tools do make things easier for teachers and students. With AI, it's sometimes quicker to help students who are struggling, put together lesson materials, or offer new ways to learn and participate. Still, concern exists. Sometimes you wonder if the information is right or if private details are being kept safe. You might ask yourself if everyone is being treated fairly, who's behind the things you read, and when to trust the AI's answer instead of your own common sense. The challenge in education is more than just learning to use new tools. As technology changes, today's cutting-edge systems will become normal. The real question is whether students can understand and make good decisions about systems that use data to represent people and problems, generate results, and affect important choices. Students need opportunities to ask:

- What is this system designed to do?
- What information does it use?
- How has the problem been represented?
- How does the system decide if it did a good job?
- What is the system able to notice, and what might it miss?

- Who gains from how the system operates?
- Who might get the system wrong, leave out, or even hurt?
- When should you trust the system's answer, double-check it, change it, or ignore it altogether?

These questions are at the heart of AI literacy. But just knowing why they matter is not enough for good teaching. Teachers need to decide how to present the problem, what students will look at, what choices students will make, what resources and support are needed, and how to know if students are learning. AI literacy is about how we shape the whole learning experience. Teachers have to set clear goals, choose and adapt resources, anticipate what students might need, organize how everyone participates, and figure out the best ways to check for understanding. They don't just hand out ready-made lessons; they mix things up to fit the subject, their students, and what's happening in their school. Research shows that teachers are always adapting and tweaking materials based on what works for their class and the realities of their school or community. AI literacy increases the visibility and complexity of instructional design responsibilities.

AI literacy makes instructional design more visible and complex. It covers technical ideas and also topics like language, evidence, creativity, identity, work, fairness, authority, and power. AI literacy is important in every subject, including math, science, history, and English language arts. Teachers can't take a pre-made lesson and call it a day. Each teacher has to figure out what AI literacy looks like for their own students, in their own classroom and school. Teachers need to link AI ideas to their subject, identify meaningful problems, design student-focused tasks, consider

ethical and social issues, and look for evidence of student thinking.

AI Literacy Is an Emerging Field

AI literacy means being able to make sense of the technology that's all around us. You don't need to be an expert, but you should know what AI is and how it fits into daily life. It helps to try out different tools and see what they can do—and where they fall short. You need to look at the answers AI gives you and think about whether they add up. The information AI uses comes from data, so how that data is chosen and handled makes a difference. Most of all, it's about using these tools in a way that's fair and careful, especially since the results can shape real people's lives. Being able to talk about AI with others and work together when using it, is just as important as knowing how it works.

Different frameworks flesh out these features in their own way. For example, the AI4K12 “Five Big Ideas” framework focuses on how AI perceives the world, how it represents and reasons about information, how it learns and improves, how people interact with it, and what impact it has on society. UNESCO's frameworks add an emphasis on Human-Centered Design, ethics, and creativity, alongside technical skills. The OECD and European Commission frameworks emphasize the importance of responsible use, management, and even the design and creation of AI systems. The focus is on helping students understand, use, question, and act responsibly with AI, including skills that are relevant across all subjects and future careers. Overall, these frameworks point to three main perspectives.

First, AI literacy is built on several core ideas: understanding how AI works, knowing when and how to use it, and thinking critically about its effects (Long & Magerko, 2020; Ng et al., 2021). Students should move beyond seeing AI as a mysterious tool and begin to explain how AI systems use data, recognize patterns, and work toward goals defined by people. This is critical to help them understand why an AI system may perform well in one context and poorly in another. These ideas should be introduced in ways appropriate to students' age, learning needs, and subject area while meeting students' diverse learning needs.

Second, it is critical to use AI with strong judgment. International organizations such as UNESCO have published reports that emphasize the need for students to receive guidance on when and how to rely on AI, identifying situations where it is appropriate to use it across different contexts (Miao & Cukurova, 2024). This includes developing the ability to recognize when to protect personal or sensitive information and when to seek human input or verification. More broadly, responsible use of AI requires students to think through how well a particular tool fits their goals, the nature of the task, and the broader ethical landscape. Ethical questions are often critical when students consider bias, fairness, how data might be misused, and the unintended effects of using AI (Boyd & Crawford, 2012; Benjamin, 2019).

Third, critical examination in AI education asks students to consider the wider impact that AI technologies can have on society. Learners are encouraged to dig deeper - examining how problems are defined by AI, how algorithms are being designed in shaping decisions, how people are represented, and who benefits

from the trade-off decisions. Research by Noble (2018) shows that search engines can reinforce people's stereotypes, showing that the results returned are shaped by cultural assumptions and the data that feed these systems. Buolamwini and Gebru (2018) found that commercial facial-analysis systems were often less accurate for women and people with darker skin tones. This shows how AI can reinforce inequality when the data and design fail to represent all groups. Similarly, Ruha Benjamin (2019) shows that automated tools in healthcare and criminal justice can make decisions that favor certain groups when the systems haven't been audited for bias or transparency. Given these diverse scenarios, students can be encouraged to ask who built the system, whose perspectives were considered, and who might be left out of the equation.

These three aspects are deeply interconnected. Technical understanding helps students recognize what an AI system can and cannot do. Critical thinking reveals how design choices carry social meaning, while ethical judgment guides responsible action (Scardamalia & Bereiter, 2006; Laurillard, 2012). However, research points out that having a framework is only a starting point. As Casal-Otero et al. (2023) observe, frameworks often outline what AI literacy should include but rarely provide specific strategies for teaching it across different subjects and age groups.

The final challenge is assessment. Druga and Ko (2021) found that assessing higher-order skills is challenging because these abilities require students to interpret complex scenarios and make tradeoffs while considering the interests of different stakeholders. Their research with children revealed that students needed to actively engage with AI - experimenting with systems, analyzing results, and reflecting on the process to develop a genuine understanding.

This is hardly a new issue in education. Papert (1980), for example, believed that true understanding grows from building and experimenting with technology, not just from listening to or reading about it. In the same spirit, Scardamalia and Bereiter (2006) emphasized the importance of giving students space to ask their own questions, try things out, and revisit their ideas as they go. When classrooms give students a chance to design, train, or test AI for themselves—as seen in recent classroom studies (Williams et al., 2023)—learners start to see both the strengths and the limits of these systems. They also become more aware of fairness, transparency, and the bigger impact technology can have on people’s lives.

For teachers, fostering AI literacy means creating classrooms where students can get their hands dirty with real problems (Dewey, 1938; Papert, 1980). Instead of just memorizing facts, learners are invited to make choices, try out their own solutions, see what works (and what doesn’t), and rethink their approach as they get feedback or new information. This kind of learning recognizes that understanding takes time and often involves a bit of trial and error. Papert (1980) showed that when students are given the space to tinker, build, and play with technology, their understanding grows in ways that lectures alone can’t provide. Scardamalia and Bereiter (2006) argued that classrooms work best when students feel like part of a team where they can ask questions, talk things through, and revise their ideas as a group. Students are encouraged to take risks, learn from missteps, and build knowledge together with their classmates.

Teachers as Designers of AI-Literacy Learning

For teachers, there's a wealth of research showing that active, student-centered learning really makes a difference. Sawyer (2014), for instance, paints a vivid picture of classrooms where students work together sharing their ideas, challenging each other's thinking, and building new knowledge as a group. When students are given room to ask questions, talk things through, and reflect on what they're learning, they don't just remember more—they become more flexible thinkers, ready to tackle new problems as they arise (Bransford, Brown, & Cocking, 2000). Hmelo-Silver, Duncan, and Chinn (2007) have also shown that when learning is built around inquiry and real-world problems, students develop a deeper understanding and acquire the kinds of skills that transfer well to new situations—something that matters more than ever as technology changes so quickly.

Teachers who lean into these approaches know that learning often happens through conversation, hands-on projects, and working things out together (Vygotsky, 1978; Dillenbourg, 1999). These social and emotional aspects of the classroom are especially relevant to AI literacy. Students need space to wrestle with tough ethical questions, learn from peers who see the world differently, and stay open to changing their minds as they encounter new challenges (Mishra & Koehler, 2006).

Thinking about teaching as a design practice really puts teachers' creativity and decision-making at the center of the learning process. Paniagua and Istance (2018) point out that innovative teaching isn't about following a script—it's about shaping learning environments that fit the needs and dreams of the students in front of you. No two classrooms are the same, so teachers find

themselves constantly adjusting their plans, drawing on what they know about their students' interests, backgrounds, and strengths.

Kali (2008) highlights that teachers are always learning alongside their students as they mix, match, and tweak technology to fit their own classroom realities, figuring out what works (and what doesn't) through trial, reflection, and sometimes a bit of improvisation. Laurillard (2012) takes this a step further, arguing that teaching is much like engineering: it's a design science. Good teachers develop, test, and share their strategies, always looking for ways to improve. They're not just using someone else's tools—they're helping to build the body of knowledge about what really supports learning. Seeing teachers as designers shows how much agency and expertise go into making classrooms work—and how central ongoing curiosity and collaboration are to truly effective education.

Designing for Critical AI Literacy

Foundational educational theories—design thinking, the learning sciences, and reflective practice—prepare teachers to design student-centered classrooms that give students agency. Three frameworks make this foundation concrete for AI literacy. Human-Centered Design (HCD) contributes a design-thinking process that begins with the people a solution is meant to serve. The Science of Learning and Development (SoLD) synthesizes the learning sciences into an account of how relationships, environments, and experiences shape learning. The AI4K12 Five Big Ideas in AI name what students should understand about how AI systems perceive the world, represent and reason about information, learn, interact with people, and affect society. Together, these three frameworks

form the theoretical basis for the Design–Create–Reflect (DCR) competencies developed in this book.

Design Thinking

Design thinking in education starts with a basic question: Who are we designing for, and what do they really need? Brown (2008) explains that this process begins with empathy—really listening to people, noticing their challenges, and trying to see things from their point of view. In practice, this might mean students interviewing someone who uses a product, watching how people interact with technology, or simply picturing themselves in a different role or situation. Cross (2011) points out that this line of thinking pushes students to move beyond their own habits and assumptions. It opens the door for them to come up with ideas that might work better for others, not just for themselves.

Bringing design thinking into AI literacy makes these values especially relevant. For instance, Carroll and colleagues (2010) found that when students worked on digital design projects, they had to grapple with how their choices would affect different groups—sometimes even realizing that an algorithm or tool might unintentionally leave some people out. These moments of realization help students see that design is never neutral and that technology can easily reinforce biases unless we deliberately work against it (Nissenbaum, 2001; Benjamin, 2019).

Creativity is at the core of design thinking. As Sawyer (2012) showed, solving new problems requires the ability to identify new problems and try things that might not work the first time. Students are invited to brainstorm, sketch rough drafts, and test their solutions, whether in the classroom or with simple models

(Razzouk & Shute, 2012). Through the iterative process, students revise it and try again. Liedtka (2018) points out that this trial-and-error approach builds resilience and helps students become comfortable with change, which is a critical skill in today's complex social environment.

Collaboration is one of the core components of design thinking. When students engage in collaborative problem-solving, they need to actively listen and share ideas, resolve conflicts, and negotiate differing viewpoints (Brown, 2008; Cross, 2011). This approach encourages learners to consider questions from multiple perspectives, which results in more innovative solutions. As noted by Dillenbourg (1999), the process of mutual support and intellectual challenge among peers enriches cognitive development and leads to better learning outcomes in knowledge building. Overall, design thinking encourages students to take on new challenges with empathy and creativity. This creates an opportunity for teachers to prepare students to design curricula that serve students with diverse needs.

Learning Sciences

Darling-Hammond et al. (2018) suggest that learning is most effective when it is active, social, and meaningful. Their research pulls together decades of work in the learning sciences to show that students build understanding by connecting new ideas to what they already know, tackling real-world challenges, and working alongside others. Teachers should create space for students to explore how these systems affect their own lives, use those relevant examples to initiate the discussion, and give students agency to build conversation in each classroom exercise.

A takeaway from Darling-Hammond et al. (2018) is the value of relationships and classroom climate. When students feel that their voices matter and their backgrounds are respected, they're more willing to ask questions, try new things, and learn from mistakes. Especially in classrooms with students from diverse cultural backgrounds, it is critical for students to feel a sense of ownership and to see their home culture respected and brought into day-to-day conversation.

Another key point is that learning should meet the needs of students with diverse learning needs. Teachers should consider designing a space that engages diverse students' learning voices and provides instruction, drawing on students' interests and experiences. In the context of AI literacy, this could look like giving students the freedom to choose which technologies or ethical questions they want to explore or inviting them to take a closer look at the algorithms that influence their online experiences, or encouraging students to step back and reflect on how AI might be affecting society.

What Darling-Hammond et al. (2018) highlight is that students learn best when the material connects to their lives, when they feel a sense of belonging, and when they have time to reflect and collaborate. For teachers, this means creating opportunities where students can wrestle with meaningful questions about AI, help one another learn and grow, and build confidence in their ability to think critically - even as the world and technology keep changing around them.

Reflective Practice

Reflection is a habit of mind that encourages students to think about how and why they've learned something, not just what they've learned. Scardamalia and Bereiter (2006) describe this kind of reflective practice as central to real learning. It's about asking questions, noticing misunderstandings, and coming back to ideas to see them in a new light. When students practice reflection, they become better at figuring out what they know, what they don't, and what they might do differently next time (Zimmerman, 2002; Schön, 1983).

Bringing reflection into AI literacy opens the door for students to make sense of some of the biggest questions we face with new technology. For example, as they explore the Five Big Ideas in AI—perception, representation and reasoning, learning, natural interaction, and social impact (Touretzky et al., 2019)—students can be prompted to consider whose perspectives are reflected in an algorithm, who might be left out, and what values are built into the system (Benjamin, 2019; Nissenbaum, 2001). Teachers can create space for these conversations and encourage students to reflect. This process helps students connect what they're learning about technology with their own values and sense of responsibility.

By weaving empathy, creativity, collaboration, meaning making, and reflection into the classroom, teachers give students tools not just to use AI but to question it, challenge it, and imagine how it could be better. These foundational ideas don't lock us into a single lesson plan or method; instead, they offer a way to make AI literacy more meaningful and deeply connected to students' lives. In the

next chapter, we'll look at how these values play out in real classrooms—through design, creation, and reflection that bring AI literacy to life.

Supporting Teachers to Develop AI Literacy

Teachers are more likely to develop confidence with AI when professional learning is connected to their classroom responsibilities, supported over time, and undertaken with colleagues. Research in this area points to four recurring conditions: perceived relevance, adequate time and support, opportunities for collaboration, and feedback on practice.

Nazaretsky et al. (2022) discovered a correlation between teachers' attitudes towards AI literacy and the success of their professional development. Teachers who displayed positive attitudes and beliefs towards the integration of AI technologies were more likely to engage meaningfully in professional development initiatives. This emphasizes the importance of fostering a positive mindset among educators as a foundational element for successful AI literacy training. Guilherme (2019) research highlighted the significance of teachers' perception of the relevance of AI in education. Professional development initiatives that effectively communicate the practical applications and benefits of AI in teaching are more likely to be successful. Teachers are more inclined to invest in AI literacy when they see its direct impact on enhancing their teaching methods and student outcomes.

Sanusi et al. (2023) identified that support systems are crucial factors influencing the success of teachers' professional development in AI literacy. Lack of time, support, and training emerged as common concerns among educators. Successful

professional development programs address these concerns by providing adequate resources, mentorship, and ongoing support, creating an environment conducive to continuous learning and skill development. Customized professional development also plays a pivotal role in AI literacy initiatives. Tailoring training programs to meet the diverse needs and skill levels of educators ensures greater engagement and relevance. This personalized approach acknowledges the individual preferences and learning styles of teachers, contributing to the overall success of AI literacy training.

Additionally, fostering collaborative learning environments emerged as a key factor in the success of teachers' professional development in AI literacy (Lee et al., 2021). When educators have opportunities to collaborate, share experiences, and learn from one another, the effectiveness of professional development initiatives is amplified. Peer support and collaboration create a community of practice that sustains ongoing learning and application of AI literacy skills. Finally, evaluating teachers' progress and providing constructive feedback are essential components in successful AI literacy professional development (Deneen & Hoo, 2023). Clear assessment criteria and timely feedback help educators track their growth, identify areas for improvement, and refine their AI literacy skills. This iterative process contributes to the continuous improvement of AI literacy competencies among teaching professionals.

Classroom Resources

The tools and materials below can support the foundational AI-literacy activities and lesson preparation in this chapter, from

teacher background reading to hands-on machine-learning demonstrations:

The A-Z of AI. A collection of short, illustrated explainers — one for each letter of the alphabet — that introduce core AI ideas such as bias, neural networks, and machine learning in plain language. Produced by Google with the Oxford Internet Institute, it works well as a first orientation for teachers or as a jigsaw reading for students (<https://atozofai.withgoogle.com>).

Elements of AI. A free, self-paced online course from the University of Helsinki and MinnaLearn that explains what AI is, what it can and cannot do, and how it affects society — with no programming or advanced math required. A strong option for building teacher background knowledge before teaching the DCR lessons (<https://www.elementsofai.com>).

Day of AI. Free, classroom-ready K–12 AI-literacy curriculum, assessments, and teacher professional development from MIT RAISE, spanning algorithms, generative AI, and AI ethics. Its design-oriented units pair naturally with the approach in this book (<https://dayofai.org>).

AI4K12. The national guidelines and resource directory that organize K–12 AI education around the Five Big Ideas — perception, representation and reasoning, learning, natural interaction, and societal impact. Its curated demo directory is the source for many of the tools listed in later chapters (<https://ai4k12.org>).

AI in the Movies. Film-trailer clips (for example, *Big Hero 6*, *Free Guy*, *Iron Man 3*, and *Chappie*) used as a discussion hook: students

list the AI they notice and sort depictions into realistic versus fictional to surface prior conceptions.

Machine Learning for Kids. A free tool that guides students through collecting training examples, building a model, and then using it inside a Scratch or Python project. It makes the train–test–improve cycle concrete for upper-elementary and middle-grades learners (<https://machinelearningforkids.co.uk>).

Code.org: AI for Oceans. A short, self-contained activity in which students train a classifier to sort ocean objects and then see how biased or incomplete training data changes the model's behavior — an accessible first encounter with machine learning and bias (<https://code.org/oceans>).

Quick, Draw! (Google). A browser game in which a neural network guesses players' doodles in real time, drawing on a dataset of millions of drawings. Useful for prompting students to reason about how a system recognizes patterns and why it sometimes fails (<https://quickdraw.withgoogle.com>).

Python Like You Mean It. A free online resource that teaches Python fundamentals with an emphasis on the numerical tools used in data science and machine learning — a bridge for teachers or older students moving beyond block-based tools (<https://www.pythonlikeyoumeanit.com>).

Calypso for Cozmo. A tile-based programming environment created by Dave Touretzky for Anki's Cozmo robot. It makes university-level robotics ideas — perception, world modeling, and behavior

— visible and programmable for children (<https://calypso.software>).

Teacher tools and AI assistants. For lesson preparation, differentiation, and modeling responsible AI use — Diffit (<https://app.diffit.me>), Khanmigo (<https://www.khanmigo.ai>), MagicSchool AI (<https://www.magicschool.ai>), CK-12 Flexi (<https://www.ck12.org/flexi>), and the Craiyon image generator (<https://www.craiyon.com>) — together with general assistants such as Claude (<https://claude.ai>), ChatGPT (<https://chat.openai.com>), Gemini (<https://gemini.google.com>), Microsoft Copilot (<https://www.bing.com/chat>), and Google Labs (<https://labs.google>).

AI-literacy competency frameworks. Beyond the AI4K12 Five Big Ideas noted above, teachers can consult the field's other competency frameworks: Long and Magerko's (2020) synthesis of AI-literacy competencies, Ng et al.'s (2021) four-aspect review — know and understand, use and apply, evaluate and create, and ethical issues — and UNESCO's competency frameworks for students and teachers (Miao & Cukurova, 2024).

DAILY (Developing AI Literacy). A thirty-hour middle-school curriculum from MIT RAISE that integrates technical AI concepts, ethics, and AI-related career futures, with published pilot results (Lee et al., 2021).

PopBots. A curriculum and social-robot platform designed to introduce preschool and early-elementary children to foundational AI ideas such as knowledge-based systems and supervised machine learning (Williams et al., 2019).