




# AI Literacy: A Framework to **Understand, Evaluate, and Use**

## Emerging Technology

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人工智能素养：一个框架

# 理解、评估和使用

## 新兴技术

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# Introduction

Generative AI (GenAI) systems and tools are entering the classroom at a rapid pace. Given the well-documented examples of AI tools perpetuating and reproducing systemic bias (Benjamin, 2019; Broussard, 2023; Buolamwini, 2023; Noble, 2018; O’Neil, 2016) and violations of data privacy (Ingram, 2023; Federal Trade Commission, 2024), concern and skepticism is well-founded. *What will educators and learners need to know and be able to do in order to use AI safely and effectively?*

**Digital Promise believes that safe and effective use of AI requires informed users and therefore calls on school leaders and policymakers to support AI literacy for all learners, educators, and community members to use emerging tech responsibly. We define AI literacy as follows:**

***AI literacy includes the knowledge and skills that enable people to critically understand, evaluate, and use AI systems and tools to safely and effectively participate in an increasingly digital world.***

For educators, the development of AI literacy is a necessary prerequisite to harnessing the power of emerging technologies for powerful teaching and learning. For learners, AI literacy can equip them with essential skill sets to responsibly use emerging technology for the good of society throughout their lives and in the workforce (World Economic Forum, 2024). Using the concepts of AI literacy, learners, leaders, educators and caregivers can work collaboratively to make more informed decisions about if and how to adopt emerging technologies to promote safe and effective use of AI tools in our lives.

To enable all who participate in educational settings to leverage AI tools for powerful learning, this paper describes a framework and strategies for educational leaders to design and implement a clear approach to AI literacy for their specific audiences (e.g. learners, teachers, or others). The first part of the paper describes a framework that identifies essential components of AI literacy and connects them to existing initiatives. The second part of the paper identifies strategies and illustrative examples as guidance for educational leaders to integrate AI literacy in K–12 education and adapt to their unique contexts.

# 引言

生成式人工智能（GenAI）系统与工具正以惊人速度进入课堂。鉴于已有大量文献记载AI工具加剧系统性偏见（Benjamin，2019；Broussard，2023；Buolamwini，2023；Noble，2018；O’Neil，2016）及侵犯数据隐私（Ingram，2023；美国联邦贸易委员会，2024）的案例，人们的担忧与质疑实属合理。教育工作者与学习者需要掌握哪些知识、具备哪些能力，才能安全有效地运用AI技术？

数字承诺组织认为，安全有效地使用人工智能需要用户具备充分信息，因此呼吁学校领导者和政策制定者支持所有学习者、教育工作者和社区成员负责任地使用新兴技术。我们对人工智能素养的定义如下：

**人工智能素养包括使人们能够批判性理解、评估并安全有效地利用人工智能系统和工具，从而在日益数字化的世界中参与其中所需的知识与技能。**

对教育工作者而言，培养人工智能素养是掌握新兴技术力量、实现高效教学与学习的必要前提。对学习者的来说，人工智能素养能为其提供核心技能储备，使其能在终身学习和职场实践中负责任地运用新兴技术造福社会（世界经济论坛，2024年）。通过运用人工智能素养理念，学习者、领导者、教育工作者及照护者可协同合作，就是否采用新兴技术及其应用方式做出更明智决策，从而促进人工智能工具在生活中的安全有效应用。

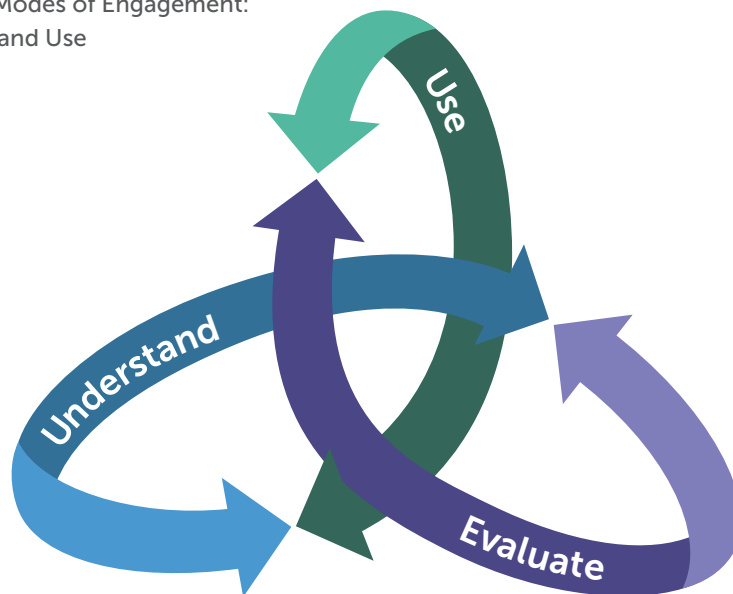
为了让所有教育工作者都能有效运用人工智能工具提升教学效果，本文提出了一套框架体系与实施策略，帮助教育管理者为不同受众群体（如学习者、教师等）设计并落实精准的人工智能素养培养方案。文章首章构建了人工智能素养的核心要素框架，并将其与现有教育项目进行关联分析。第二章则通过具体策略与案例分析，为教育管理者提供在基础教育阶段融入人工智能素养教育的实践指南，助力其因地制宜地开展适配性教学。

# AI Literacy Framework

To provide educational leaders with a concise and comprehensive AI Literacy Framework, Digital Promise took several perspectives into account. We incorporated insights about AI literacy from research-based frameworks such as Almatrafi et al., 2024, Druga et al., 2021, Ng et al., 2021 and Lee and Long (in press). From an ethical decision making perspective, we considered the SAFE Benchmarks Framework (EdSAFE AI Alliance, 2024). Finally, from a human justice perspective, we bring in the considerable body of research and journalism on algorithmic and technological bias (e.g., Benjamin, 2019; Broussard, 2023; Buolamwini, 2023; Noble, 2018; O’Neil, 2016) and work within education on responsible AI and tech justice (White & Scott, 2024). We also took into account a longstanding history and research base of related media and computational literacies and their existing and historical applications in school settings. Based upon this body of work and listening to practitioners, we recognized that understanding, evaluating, and using are interconnected ways to engage with AI. Building and facilitating AI literacy necessitates all three. Further, understanding and evaluating AI is critical to making informed decisions about if and how to use AI in different contexts. Underscoring our framework is human judgment and justice, which are core values for applying AI in appropriate contexts and mitigating the harmful effects of algorithms.

The framework, pictured below, includes three **Modes of Engagement**: Understand, Evaluate, and Use. The interconnectedness of the framework indicates that Understanding, Evaluating, and Using happen concurrently and together support robust engagement in AI literacy.

**Figure 1.** AI Literacy Framework includes three interconnected Modes of Engagement: Understand, Evaluate, and Use



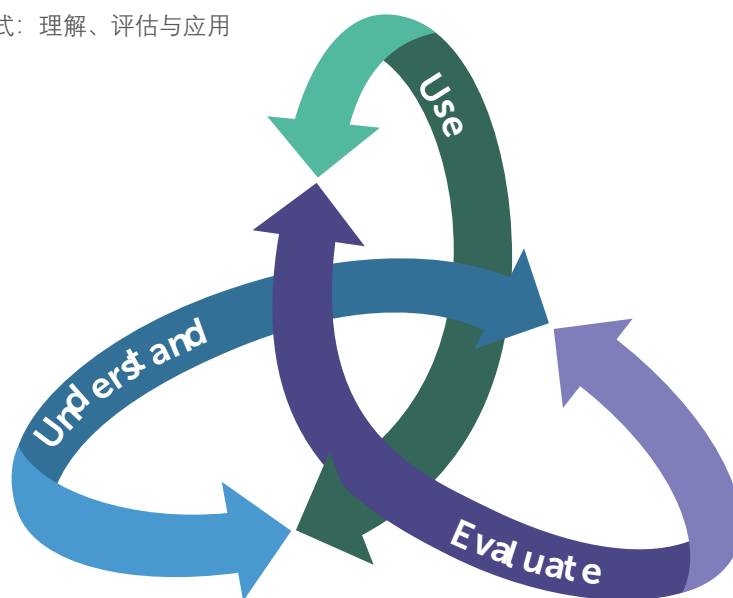
# 人工智能素养框架

为向教育领导者提供简明全面的人工智能素养框架，数字承诺项目综合考量了多维度视角。我们借鉴了Almatrafi等人（2024）、Druga等人（2021）、Ng等人（2021）以及Lee与Long（待刊）等研究框架中关于人工智能素养的见解。在伦理决策层面，我们参考了SAFE基准框架（EdSAFE人工智能联盟，2024）。从人类正义视角出发，我们整合了大量关于算法与技术偏见的研究成果及新闻报道（如Benjamin, 2019; Broussard, 2023; Buolamwini, 2023; Noble, 2018; O’Neil, 2016），并在教育领域推进负责任人工智能与技术正义实践（White & Scott, 2024）。同时，我们充分考虑了相关媒体素养与计算素养的悠久历史研究基础，及其在学校教育中的实际应用与历史积淀。基于这些研究成果并结合行业实践者反馈，我们认识到理解、评估与应用是与人工智能互动的三重维度。构建与促进人工智能素养发展需要这三者协同推进。此外，理解与评估人工智能（AI）对于在不同情境中做出是否及如何使用AI的明智决策至关重要。我们框架的核心在于人类判断与正义，这些是将AI应用于适宜场景并减轻算法有害影响的核心价值。

下图所示的框架包括三种**参与模式**：理解、评估和使用。该框架的相互关联性表明，理解、评估和使用是同步发生的，并共同支持人工智能素养的稳健参与。

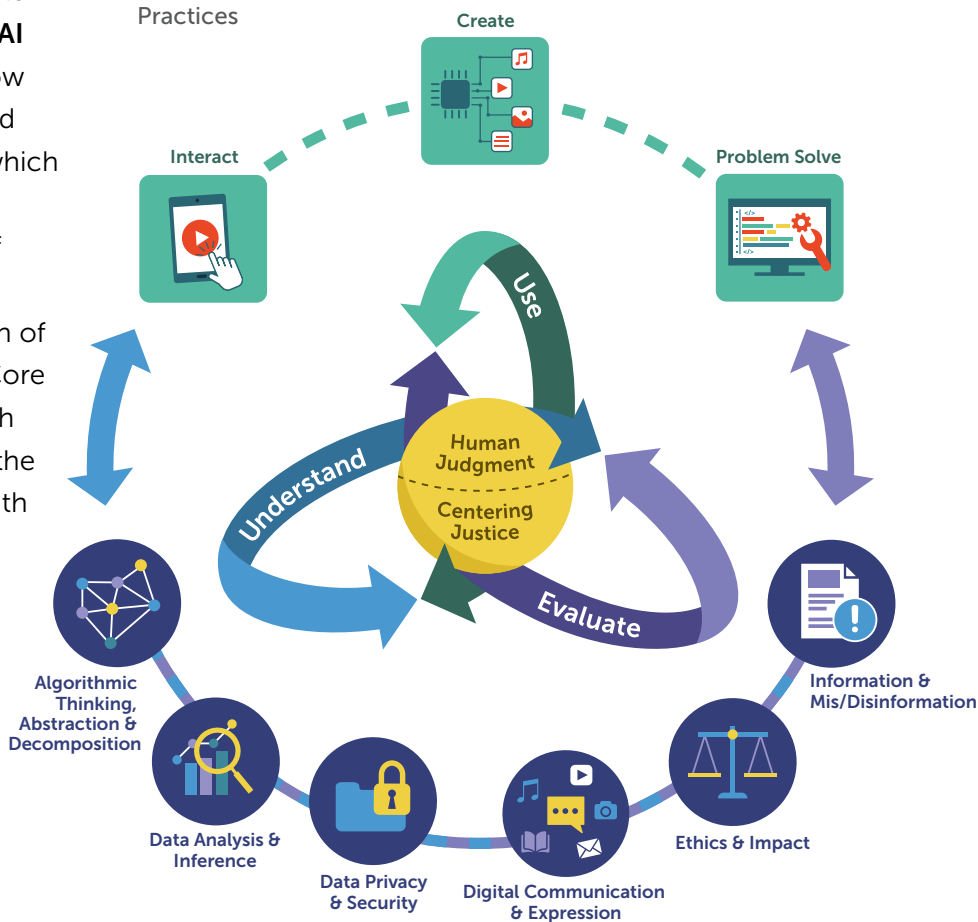
图1.AI素养框架包括

三种相互关联的参与模式：理解、评估与应用



We describe essential components of AI literacy for educational leaders to adapt to their contexts, including **AI Literacy Practices** to articulate how users engage in understanding and evaluating AI systems and tools, which are underpinned by **Core Values** that emphasize the importance of centering human judgment and centering justice in any application of AI. The AI Literacy Practices and Core Values are operationalized through three **Types of Use**. The figure to the right elaborates our framework with each of the components.

**Figure 2.** Expanded AI Literacy Framework, including Core Values, Modes of Engagement, Types of Use, and AI Literacy Practices



**Table 1.** Components of the AI Literacy Framework

Framework Component	Description	Examples
<b>AI Literacy Practices</b>	Actionable practices of understand and evaluate that learners can demonstrate	Data Privacy & Security, Information & Mis/Disinformation
<b>Core Values</b>	Underlying principles that support learners to safely and effectively use AI tools	Human Judgment, Centering Justice
<b>Modes of Engagement</b>	Interconnected ways users can engage with AI-enabled tools in order to demonstrate AI literacy	Understand, Evaluate, Use
<b>Types of Use</b>	Distinct purposes for which users engage with AI-enabled tools	Interact, Create, Problem Solve

Each component of this framework is elaborated in the following sections of this paper. We begin by describing the AI Literacy Practices and connecting them to existing initiatives.

我们阐述了教育领导者需要适应自身情境的人工智能素养核心要素，包括**人工智能素养实践**——用以阐明用户如何理解和评估人工智能系统及工具，这些实践以强调在人工智能应用中必须以人类判断为核心、以正义为准则的**核心价值观**为支撑。人工智能素养实践与核心价值观通过三种**使用类型**具体化呈现。右侧示意图详细阐释了该框架的各组成部分。

图2.扩展的人工智能素养框架，包括核心价值观、参与模式、使用类型和人工智能素养实践



表1.AI素养框架的组成部分





框架组件	描述	示例
人工智能素养实践	可操作的实践方法：理解与评估学习者能否展示其能力	数据隐私与安全 信息与虚假/误导性信息
核心价值观	支持学习者安全有效使用人工智能工具的基本原则	人类判断，以正义为中心
参与模式	用户与人工智能工具互动的互连方式，以展示人工智能素养	理解、评估、应用
使用类型	用户使用人工智能工具的具体目的	互动、创造、解决问题

本框架的每个组成部分将在本文后续章节中详细阐述。我们首先描述人工智能素养实践，并将其与现有倡议进行关联。

# AI Literacy Practices

AI Literacy Practices are actionable skills that learners can demonstrate. These practices define how users can **Understand** and **Evaluate** AI-enabled tools and how educators can support AI literacy development. Breaking down complex topics such as AI literacy into practices can support leaders to define and implement AI literacy programs in their contexts. For example, AI Literacy Practices can be used to develop integrated learning opportunities or tools such as walk-through documents for coaches/administrators and formative assessments for teachers (Mills et al., 2020). In the table below, we provide descriptions and examples of each of the AI Literacy Practices.

**Table 2.** Description and Look fors for six AI Literacy practices



AI Literacy Practice	Description	Student Look Fors
 <b>Algorithmic Thinking, Abstraction &amp; Decomposition</b>	Develop and/or use a computer's ability to recognize data and create a prediction or perform an action based on both the situation and stored information without explicit human guidance.	<ul style="list-style-type: none"> <li>• Training and/or prompting AI tools and systems</li> <li>• Defining procedures as algorithms</li> <li>• Testing and debugging</li> <li>• Breaking down problems into smaller parts</li> </ul>
 <b>Data Analysis &amp; Inference</b>	Consider the context of datasets, data visualizations, and data collection with criticality. Assess quality of training data for AI tools and leverage AI models and methods to collect, analyze, and visualize data.	<ul style="list-style-type: none"> <li>• Determine quality (accuracy, completeness, validity, etc.) of dataset</li> <li>• Analyzing and organizing datasets</li> <li>• Describing patterns and relationships</li> <li>• Evaluating and deducing information</li> </ul>
 <b>Data Privacy &amp; Security</b>	Develop awareness of data privacy and security while fostering ownership and agency of how to protect data in AI-enabled systems. This includes the privacy and security of personal data collected by an AI system or tool and how that data is used.	<ul style="list-style-type: none"> <li>• Identifying how personal information is being collected, used, and shared</li> <li>• Preventing tools from collecting data and/or deleting data that was collected</li> <li>• Investigating AI models and methods that were used to develop a tool</li> <li>• Identifying datasets that were used to train an AI model</li> </ul>
 <b>Digital Communication &amp; Expression</b>	Understand how AI Systems create synthetic content, evaluate synthetic AI creations, and consider ethical responsibilities when consuming, creating, and sharing AI-enabled products.	<ul style="list-style-type: none"> <li>• Understand norms and best practices of use, development, and application AI systems</li> <li>• Evaluate outputs of AI-enabled system for appropriate tone, audience, and content</li> <li>• Responsibly engage in the consumption, creation, or sharing of AI-enabled products, including ethical sourcing and citation</li> </ul>

## 人工智能素养实践

人工智能素养实践是学习者可实际应用的技能。这些实践明确了用户如何**理解**和**评估**人工智能工具，以及教育工作者如何支持人工智能素养发展。将人工智能素养等复杂主题分解为具体实践，有助于领导者在各自场景中制定并实施相关项目。例如，人工智能素养实践可用于开发整合式学习机会或工具，如为教练/管理者提供的操作指南文档，以及为教师设计的形成性评估（Mills 等，2020）。下表详细列出了各项人工智能素养实践的描述与示例。

表2.六种人工智能素养实践的描述与观察指标

人工智能素养实践	描述	学生福克斯
 <b>算法思维、抽象与分解</b>	开发和/或利用计算机识别数据的能力，使其能够在无需明确人工指导的情况下，根据情境及存储信息生成预测或执行操作。	<ul style="list-style-type: none"><li>• 训练和/或提示人工智能工具与系统</li><li>• 将程序定义为算法</li><li>• 测试与调试</li><li>• 将问题分解为更小的部分</li></ul>
 <b>数据分析与推断</b>	需结合数据集、数据可视化及数据采集的关键性背景进行考量。评估人工智能工具训练数据的质量，并运用AI模型与方法进行数据采集、分析及可视化处理。	<ul style="list-style-type: none"><li>• 评估数据集质量（准确性、完整性、有效性等）</li><li>• 数据分析与数据集整理</li><li>• 描述模式和关系</li><li>• 评估与信息推导</li></ul>
 <b>数据隐私与安全</b>	在培养人工智能系统中数据保护责任意识与自主决策能力的同时，提升数据隐私与安全意识。这包括人工智能系统或工具所收集个人数据的隐私与安全问题，以及这些数据的使用方式。	<ul style="list-style-type: none"><li>• 识别个人信息的收集、使用及共享方式</li><li>• 防止工具收集数据和/或删除已收集数据</li><li>• 研究用于开发工具的人工智能模型与方法</li><li>• 识别用于训练人工智能模型的数据集</li></ul>
 <b>数字传播与表达</b>	了解人工智能系统如何生成合成内容，评估合成AI创作成果，并在使用、创作和分享AI赋能产品时考量伦理责任。	<ul style="list-style-type: none"><li>• 了解人工智能系统使用、开发及应用的规范与最佳实践</li><li>• 评估人工智能系统在语调、受众及内容方面的输出效果</li><li>• 负责任地参与消费、创造或分享人工智能产品，包括道德采购和引用</li></ul>



 <b>Ethics &amp; Impact</b>	Examine the outputs of algorithms and question the biases inherent in the AI systems and tools being used. Consider the benefits and harms of AI tools to the environment, people, or society. Importantly, it includes considering how datasets, including their accessibility and representation, reproduce bias in our society.	<ul style="list-style-type: none"> <li>• Understand how values, beliefs, and points of view are applied through AI-enabled systems and outputs</li> <li>• Determine if and how an AI algorithm is the right tool for the job</li> <li>• Consider the benefits and/or costs of AI to individuals, society, and the environment</li> <li>• Understand if AI is perpetuating issues of access and equity</li> </ul>
 <b>Information &amp; Mis/Disinformation</b>	Determine credibility of AI system outputs in digital landscapes. This includes evaluating datasets and AI products/outputs for false, inaccurate or misleading information.	<ul style="list-style-type: none"> <li>• Analyze and synthesize multiple perspectives to support lateral reading</li> <li>• Cite valid, reliable data and evidence that apply in a variety of situations across contexts.</li> <li>• Evaluate the credibility or accuracy of an output or prediction</li> <li>• Identify how bias in data collection informs reporting</li> </ul>

These AI literacy practices support learners to understand and evaluate AI systems and tools. It's important to note that each of these practices can be learned and/or taught without the use of an AI tool. In fact, we suggest that learners should explicitly engage in AI literacy skill development (such as analyzing and organizing datasets) without AI tools, particularly in the early grades. Existing initiatives, such as media literacy, digital citizenship, computational thinking and data literacy provide useful guidance and resources for leaders to understand how to build capacity for AI literacy. We elaborate on connections to existing initiatives and AI literacy practices in the following section.

## Connecting AI Literacy to Existing Initiatives

AI literacy skills connect to initiatives that educators have been discussing and implementing in response to emerging technologies for decades. These include, but aren't limited to, computational thinking, data literacy, digital citizenship, and media literacy. These deep connections can allow school leaders to expand on existing initiatives and learning pathways to include AI literacy, or to introduce additional related learning objectives alongside AI literacy initiatives. Below, we explain how AI literacy practices are connected to existing initiatives, illustrated in Figure 3.

**Computational thinking**, defined as solving problems systematically so that a computer could support the process or product development (Mills et al., 2021). Computational thinking includes practices such as automation, data practice, and modeling and relates to AI literacy practices such as algorithmic thinking, abstraction and decomposition, information and mis/disinformation, data analysis and inference, and communication and expression.

 <b>伦理与影响</b>	<p>需分析算法输出结果，质疑所用人工智能系统及工具中固有的偏见。</p> <p>评估人工智能工具对环境、人类或社会的利弊影响。关键在于需考量数据集（包括其可获取性与代表性）如何在社会中再生产偏见。</p>	<ul style="list-style-type: none"> <li>了解如何通过人工智能系统和输出应用价值观、信念和观点</li> <li>确定人工智能算法是否以及如何成为该工作的合适工具</li> <li>考虑人工智能对个人、社会及环境带来的益处和/或成本</li> <li>了解人工智能是否加剧了获取机会和公平性问题</li> </ul>
 <b>信息与 米斯 虚假信息</b>	<p>评估数字环境中人工智能系统输出结果的可信度。</p> <p>这包括对数据集及人工智能产品/输出结果进行评估，以识别其中是否存在虚假、不准确或误导性信息。</p>	<ul style="list-style-type: none"> <li>分析并综合多重视角以支持横向阅读</li> <li>引用适用于不同情境背景下的有效、可靠数据与证据。</li> <li>评估输出结果或预测的可信度或准确性</li> <li>明确数据收集中的偏倚如何影响报告结果</li> </ul>

这些人工智能素养实践有助于学习者理解和评估AI系统及工具。需要特别指出的是，所有实践方法均可在不使用AI工具的情况下进行学习和教学。事实上，我们建议学习者应主动开展人工智能素养技能培养（如数据分析与数据集整理），尤其在低年级阶段更应如此。现有媒体素养、数字公民教育、计算思维及数据素养等项目，为教育工作者提供了构建AI素养能力的重要指导与资源。下文将详细阐述这些实践与现有教育项目的关联性。

## 人工智能素养与现有倡议的关联

人工智能素养能力与教育工作者数十年来针对新兴技术所探讨并实施的教育举措密切相关。这些举措包括但不限于计算思维、数据素养、数字公民意识及媒介素养。这种深度关联性使学校管理者能够拓展现有教育项目与学习路径，将人工智能素养纳入其中，或在人工智能素养项目中增设相关学习目标。下文将通过图3具体阐释人工智能素养实践与现有教育举措的关联性。

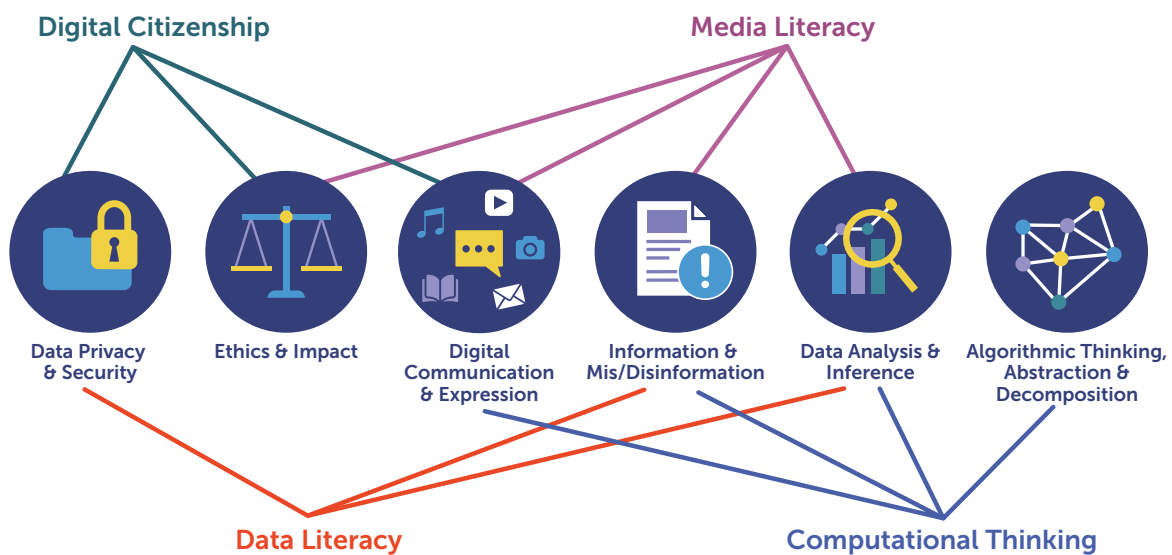
**计算思维**（定义为通过系统化问题解决方法，使计算机能够支持流程或产品开发过程，Mills 等，2021）包含自动化、数据实践与建模等实践要素，其内涵涵盖人工智能素养实践中的算法思维、抽象与分解能力、信息甄别与辨别、数据分析与推断能力，以及沟通表达能力等核心维度。

**Digital citizenship**, defined as the responsible use of technology to learn, create, and participate (James et al., 2021). Digital citizenship includes media balance and well being, privacy and security, digital footprint and identity, relationships and communication, cyberbullying, digital drama and hate speech, and news and media literacy (Common Sense Media, 2024a). It relates to AI literacy practices such as Ethics and Impact, Data Privacy and Security and Communication and Expression.

**Data literacy**, defined as interacting with data (e.g. collecting, analyzing, visualizing, interpreting) with criticality, uncertainty, and intrigue includes components such as context, aggregation, variability, visualization, and inference (Rubin et al., 2020). It connects to AI literacy practices such as data privacy and security, information and mis/disinformation, and data analysis and inference.

**Media literacy**, defined as the ability to access, analyze, evaluate, create, and act using all forms of communication includes critical analysis, inference, creative expression, bias, personal awareness, codes, conventions and constructions, mindful media habits and personal media management (National Association for Media Literacy Education, 2024). It connects to AI literacy practices such as Ethics and Impact, Information and Mis/Disinformation, Data Analysis and Inference and Communication and Expression.

**Figure 3.** Connections among AI literacy practices and Digital Citizenship, Media Literacy, Computational Thinking and Data Literacy



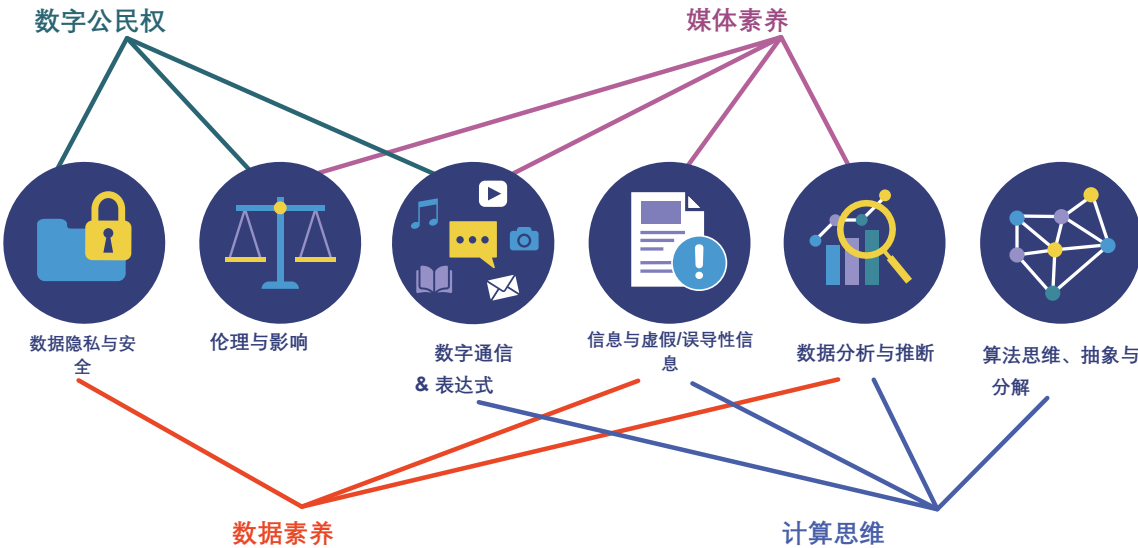
These existing initiatives provide leaders a starting point to understand how to build capacity to teach AI literacy. Learners will be better prepared to apply these practices to AI tools if they have opportunities to develop them early and often across grades and subject area learning.

**数字公民身份**是指负责任地运用技术进行学习、创作和参与社会活动（James 等，2021）。其核心要素包括：媒体平衡与心理健康、隐私安全防护、数字足迹与身份管理、人际关系与沟通技巧、网络欺凌防范、数字戏剧与仇恨言论抵制，以及新闻媒介素养培养（常识媒体，2024a）。该概念与人工智能素养实践密切相关，具体涵盖伦理与社会影响、数据隐私安全、沟通表达能力等维度。

**数据素养**，定义为以批判性、不确定性和好奇心的态度与数据互动（例如收集、分析、可视化、解读），包含上下文、聚合、变异性、可视化和推断等要素（Rubin 等，2020）。它与人工智能素养实践相关，包括数据隐私与安全、信息与虚假信息，以及数据分析与推断。

**媒体素养**是指通过各类传播媒介获取信息、进行分析评估、创作内容并采取行动的能力，具体涵盖批判性分析、推理能力、创意表达、偏见识别、个人意识培养、媒介编码规范、惯例建构、媒介使用习惯养成及个人内容管理等维度（美国国家媒体素养教育协会，2024年）。该能力与人工智能素养实践密切相关，包括伦理与社会影响、信息甄别与虚假信息识别、数据分析与推论能力，以及传播表达技巧等核心要素。

图3.人工智能素养实践与数字公民素养、媒介素养、计算素养之间的关联性思维与数据素养



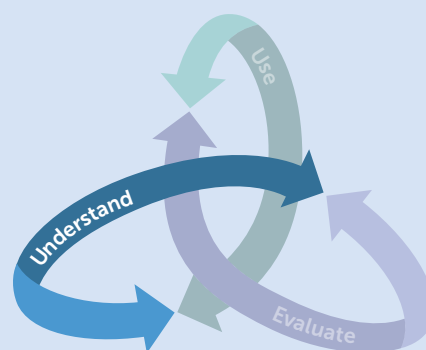
现有这些举措为领导者提供了理解如何提升人工智能素养教学能力的起点。若能在不同年级和学科教学中尽早且频繁地开展相关实践，学习者将能更好地将这些方法应用于人工智能工具的使用。

Over time we anticipate that the increasing prominence and ongoing development of AI tools will shift priority skills within these foundational literacies. For instance, programming has been viewed as a priority skill for Creating Automations, a key practice in Computational Thinking, but AI systems now have the ability to automate on their own, with human oversight, and the skills for this oversight may overtake programming as the key skill for understanding and creating automated systems. To understand how these practices are specifically applicable to AI systems, and how those skills will continue to shift with the innovation of emerging technologies, educators should have a foundational understanding of AI and how it works. In the following section, we provide an overview of AI, intended for leaders to adapt for their context and audience.

我们预计，随着人工智能工具日益凸显其重要性并持续发展，这些基础素养中的核心技能将发生转变。例如，编程曾被视为创建自动化流程的关键技能，而自动化是计算思维的核心实践。但如今人工智能系统已具备自主执行自动化任务的能力，且在人工监督下运行，这类监督技能可能超越编程，成为理解和构建自动化系统的核心能力。为理解这些实践如何具体应用于人工智能系统，以及这些技能将如何随着新兴技术的创新持续演变，教育工作者需要掌握人工智能的基本原理及其运作机制。在下文中，我们将为领导者提供人工智能概述，以便根据具体情境和受众需求进行调整。

## Understanding AI

When users are working to understand AI, they should ask “how does it work?” and “how can we make it better?” (Druga et al., 2021). Understanding AI is an essential component of AI literacy because in order to make informed decisions about using and evaluating AI, users should have a basic understanding of what AI can do and how it works. In this section, we provide a general scope of information that leaders should adapt to their unique contexts, including a brief overview of the history of AI, how it works, and how it’s being used.



### A Brief History of AI

Many people associate AI with futuristic visions of technology or Sci-Fi movies, but AI has existed for decades. It was established as a field of study in the 1950s. At its origination, it was considered a subset of mathematics and computer science. Advances in technology have enabled computational devices to become increasingly integrated throughout all sectors of life and work. Computers can now collect and store data about almost anything and are equipped with the processing speed to analyze it quickly. These advances have enabled AI to move from a field of study to a much more interdisciplinary and relevant tool.

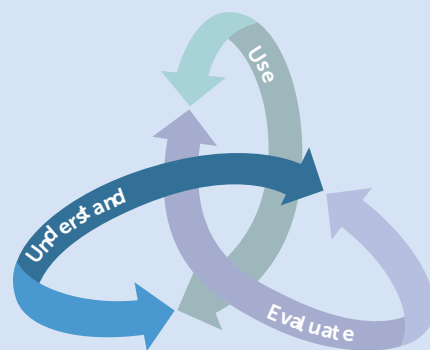
### How Does Artificial Intelligence Work?

We strongly recommend that you provide your audience with an explanation of what AI is and how it works. We recommend that this not be couched in metaphors like “human-like” or examples of AI’s powers, but rather be a mechanistic discussion. Key points it should cover include how AI uses data; that models rely on statistics and are based on identifying and analyzing key features of data; and that it synthesizes new content by using statistical models and predicting outputs, such as the next word or pixel. Of course, your own explanation may do this at many levels of detail, depending on your audience. Here we provide an example from MIT Media Lab Personal Robots Group and the MIT STEP Lab (2024) that we’ve adapted. As illustrated in Figure 4 below, AI systems are generally developed in three steps:

1. **Obtaining and curating data.** Machine Learning systems require digital data and modern life is flooded with it. This data includes pictures, text messages, all social media posts, images, and videos, and really, everything that is in digital form on the internet. People who program and develop AI tools make choices about what data to use in order to train AI systems and determine how that data is aggregated, categorized, and prioritized.

## 理解人工智能

当用户试图理解人工智能时，应当提出‘其工作原理是什么？’和‘如何改进它？’这样的问题（Druga 等，2021）。理解人工智能是人工智能素养的核心要素，因为用户若想对人工智能的使用和评估做出明智决策，就必须掌握其基本功能和运作机制。本节将为领导者提供通用信息框架，包括人工智能发展史、工作原理及应用现状的简要概述，这些内容需根据具体情境灵活调整。



## 人工智能简史

很多人一提到人工智能，就会联想到科幻电影里的未来科技场景，但其实这个领域已经存在了几十年。早在20世纪50年代，人工智能就被确立为一门独立学科。最初它只是数学和计算机科学的分支学科。随着技术进步，计算设备已深度融入各行各业。如今的计算机不仅能收集存储各类数据，还具备强大的运算能力，能快速完成分析处理。这些技术突破让人工智能从学术研究领域，蜕变为更具跨学科价值的实用工具。

## 人工智能是如何工作的？

我们强烈建议您向受众清晰阐释人工智能的本质及其运作原理。建议避免使用“类人智能”等比喻或列举AI能力实例，而应采用机械论分析框架进行讲解。核心要点需涵盖以下内容：人工智能如何利用数据；模型基于统计学原理，通过识别和分析数据关键特征构建；以及如何运用统计模型预测输出结果（如下一个单词或像素点）来生成新内容。当然，具体讲解深度可根据受众需求灵活调整。本文采用麻省理工学院媒体实验室个人机器人组与MIT STEP实验室（2024年）的研究成果作为示例。如图4所示，人工智能系统通常经历三个发展阶段：

- 1. 数据获取与整理。**机器学习系统需要海量数字数据支撑，而现代生活早已被数据洪流所淹没。这些数据涵盖图片、短信、社交媒体帖子、图像视频等各类数字形式内容，实际上就是互联网上所有以数字形态存在的信息。从事人工智能工具开发的程序员需要精心筛选训练数据，同时制定数据聚合、分类及优先级排序方案。

2. **Train a model.** Models are useful simplifications of reality. The pictures, text, posts, and videos (discussed above) are the data that inform the models; the model simplifies the actual data and only keeps a much smaller (but still very large) set of statistics about the relationships among the words, for language models, or pixels, for pictures and image models. For example, a GenAI system that creates text has statistics about the relationship among words and how they are used in language.
3. **Using the model to receive an output.** For GenAI systems that generate text, a person may ask a question in the form of a prompt. That prompt then serves as input for the statistical model. The statistical model translates this prompt into numbers. Then, it runs computations in that model to predict an output based on statistical associations. For example, text GenAI systems generate words to answer the question.

Figure 4. Diagram Overview of How AI Systems are Developed in Three Steps



What if we wanted to make a GenAI system that generates predictions as its outputs? We could consider the example of a simple AI model that could predict when a person might be hungry based on just two types of data: (1) What time of day it is and (2) When the person last had something to eat. The developers of the AI system might make a model that suggests when people might be hungry by time of day, but shifts the times later if people ate recently. We could use the model by putting in the time of day for a particular person, as well as when they last ate, and get a prediction for how hungry they are.

A more advanced model could include other relevant data, such as personalized biometric data, activity level, and the other types of food that they ate. The AI system would determine statistical associations among all of these data points in order to make a prediction as its output. AI systems apply this automation to all kinds of things that might be sensed and predicted by developing associations among billions of data points in order to make a prediction. Below, Figure 5 illustrates the inner workings of a specific type of AI model called an artificial neural network. It is arranged in layers of “nodes” representing data starting with an input layer, hidden layers as a black box, and then an output layer. The nodes are connected by lines representing weighted associations which indicate the mathematical strength of each connection. In this type of model, there are hidden layers that perform statistical functions that are intractable because of the sheer number of connections and parameters. Because we are not able to understand these models, it’s as if they are in a black box. Given AI systems and tools rely on black boxes that do not allow humans to understand how outputs are decided on, these AI systems and tools should not be used for high-stakes applications.

2. **建立模型。**模型是对现实世界的有效简化。图片、文字、帖子和视频（前文已讨论）构成了模型的数据基础；模型通过简化原始数据，仅保留关于词语间关联关系的统计信息（对于语言模型而言，这些信息以词汇形式呈现；对于图像模型，则以像素形式呈现）。例如，生成式AI系统在创建文本时，会统计词语间的关联规律及其在语言中的使用方式。
3. **利用模型接收输出。**对于生成文本的GenAI系统，用户通常会以提示形式提出问题。该提示即作为统计模型的输入，模型会将其转化为数值数据。随后，模型通过统计关联进行运算，最终生成预测结果。例如，文本生成型AI系统会生成词语来回答问题。

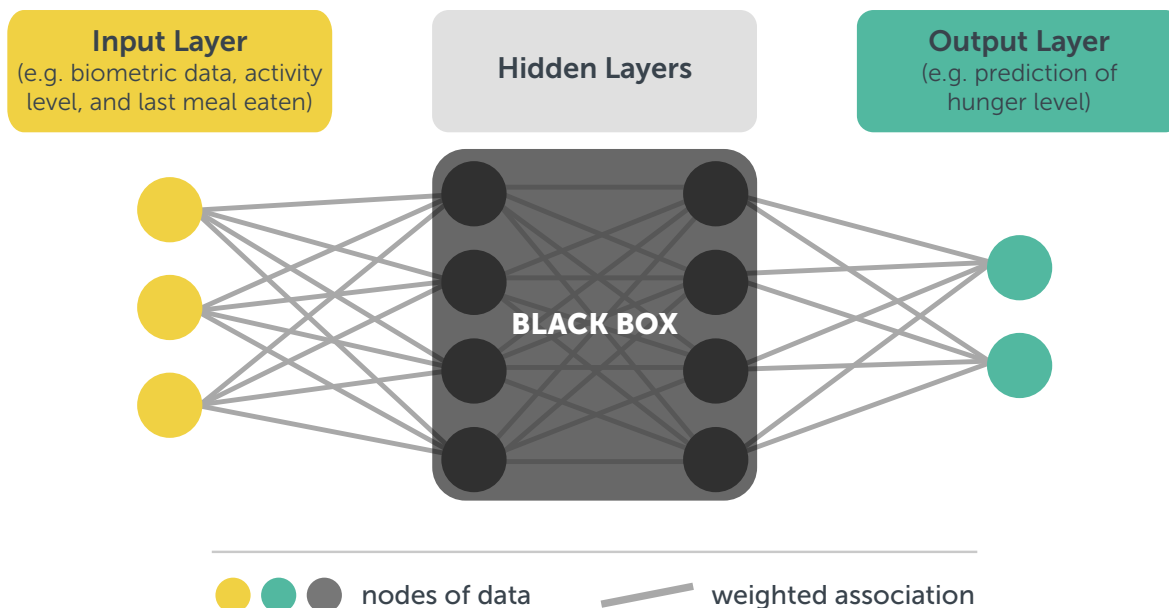
图4.人工智能系统开发三步法示意图



如果我们想开发一个以生成预测结果作为输出的生成式AI系统会怎样？可以参考这样一个简单AI模型的示例：该模型仅需两种数据就能预测一个人何时可能感到饥饿——(1)当前时间；(2)最近一次进食时间。AI系统开发者可以构建一个模型，通过每日时段预测饥饿概率，但若用户近期已进食，则会相应调整预测时间。我们只需输入特定用户的当前时间及最近进食时间，即可获得其饥饿程度的预测结果。

更先进的模型可能包含其他相关数据，例如个性化生物特征数据、活动水平以及用户摄入的其他类型食物。人工智能系统会通过分析这些数据点之间的统计关联性来生成预测结果。这类系统通过建立数十亿数据点间的关联关系，将自动化技术应用于各类可感知和可预测场景。下图5展示了名为人工神经网络的特定AI模型内部结构：模型由代表数据的“节点”分层构成，包含输入层、作为黑箱的隐藏层以及输出层。节点间通过表示加权关联的连线相连，这些连线显示了各连接的数学强度。此类模型中隐藏层执行的统计功能因连接数量和参数规模庞大而难以处理。由于我们无法理解这些模型的运作机制，它们就像处于黑箱状态。由于人工智能系统及工具依赖于黑箱机制，无法让人类理解其输出决策过程，因此这些系统及工具不应用于高风险应用场景。

Figure 5. Depiction of an Artificial Neural Network Model

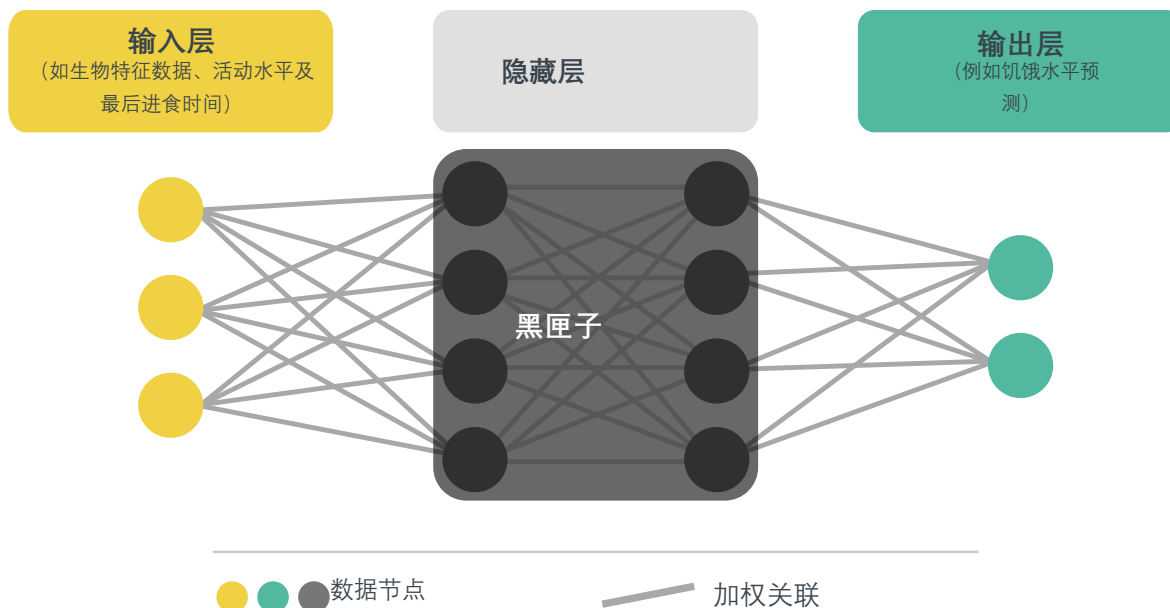


In summary, AI systems are trained with extremely large amounts of data. Computers analyze the data for patterns through automated statistical analysis, to generate a prediction or synthetic content. To train an AI system, humans must make decisions about what data to use, and how to aggregate, categorize, and prioritize each piece of data. It is important to note that with GenAI, each data point (e.g., word, pixel, etc.) is only one part of the output. Because there are multiple parts to the output, the model must be run many, many times to generate an output that has many parts, for example, an essay that has paragraphs. Next, we provide some examples of how AI is being used so that users are aware and familiar with common applications of AI, and the types of things it can do.

## How Is Artificial Intelligence Being Applied?

AI is very much integrated across tools and sectors in our day to day lives in ways that we may or may not recognize. For instance, AI systems are used for facial recognition, document translation, and personalized recommendations. In education, AI is applied for teaching, learning, assessment, and administrative tasks. Some familiar examples of how AI is currently used in education are in the table below. More detailed applications can be found as case studies in the recently released World Economic Forum (2024) report, *Shaping the Future of Learning, The Role of AI in Education 4.0*.

图5.神经网络模型示意图



简而言之，人工智能系统需要海量数据进行训练。计算机通过自动化统计分析来识别数据中的规律，从而生成预测结果或合成内容。在训练AI系统时，人类需要决定使用哪些数据，以及如何对每条数据进行整合、分类和优先级排序。需要特别说明的是，在生成式AI中，每个数据点（如单词、像素等）仅是输出结果的一部分。由于输出包含多个组成部分，模型必须经过无数次运行才能生成具有多个部分的输出，例如包含多个段落的论文。接下来我们将列举一些AI应用实例，帮助用户了解并熟悉AI的常见应用场景及其功能类型。

## 人工智能如何应用？

人工智能已深度融入我们日常生活的各个工具和领域，其渗透方式或明或暗。例如，AI系统被广泛应用于人脸识别、文档翻译及个性化推荐等领域。在教育领域，AI技术被用于教学、学习、评估及行政管理等环节。下表列举了当前教育领域中人工智能应用的典型案例，更多详细应用案例可参阅世界经济论坛（2024年）最新发布的报告《塑造学习未来：人工智能在教育4.0中的角色》。

**Table 3.** Examples of Applications of AI in Education

<b>Level of Support</b>	<b>Examples of Applications</b>
<b>Systems Support</b>	<ul style="list-style-type: none"><li>• Early warning systems</li><li>• Automation/optimization of school operations (scheduling, resource allocation, inventory, etc)</li></ul>
<b>Teacher Support</b>	<ul style="list-style-type: none"><li>• Automatic feedback/grading</li><li>• Lesson generation</li><li>• Student data analysis</li></ul>
<b>Classroom Material</b>	<ul style="list-style-type: none"><li>• Generation of activity-specific content (flashcards, quizzes, graphic organizers, differentiated content, etc.)</li></ul>
<b>Student Support</b>	<ul style="list-style-type: none"><li>• Intelligent tutoring systems</li><li>• Early reading coaches</li><li>• College/career advising</li></ul>

AI will continue to be integrated in educational contexts in existing and novel ways. Educational leaders should support all users of AI to understand and evaluate AI-enabled systems to ensure the safe, efficacious and ethical use of AI. As such, evaluating AI is a main component of our AI Literacy Framework, and discussed more in the next section.

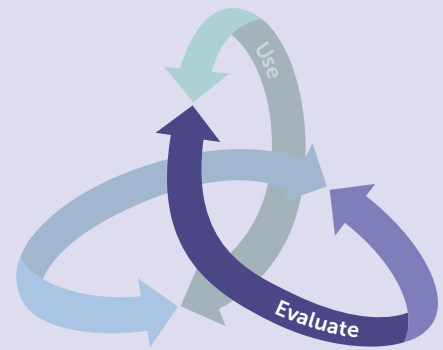
表3.人工智能在教育领域的应用实例

支持水平	应用实例
系统支持	<ul style="list-style-type: none"><li>• 早期预警系统</li><li>• 学校运营流程的自动化/优化（包括排班、资源配置、库存管理等）</li></ul>
教师支持	<ul style="list-style-type: none"><li>• 自动反馈/评分</li><li>• 课程生成</li><li>• 学生数据分析</li></ul>
课堂材料	<ul style="list-style-type: none"><li>• 生成活动特定内容（闪卡、测验、图形组织工具、差异化内容等）</li></ul>
学生支持	<ul style="list-style-type: none"><li>• 智能辅导系统</li><li>• 早期阅读教练</li><li>• 大学/职业指导</li></ul>

人工智能（AI）将继续以现有及创新方式融入教育场景。教育领导者应支持所有AI使用者理解并评估基于AI的系统，以确保AI应用的安全性、有效性及伦理合规性。因此，AI评估构成我们AI素养框架的核心组成部分，相关内容将在下一章节展开详细讨论。

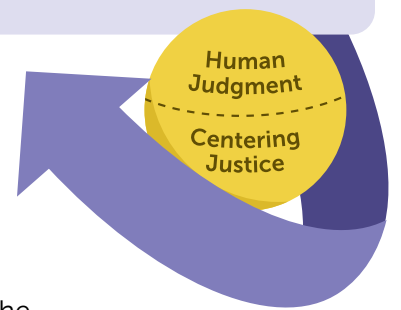
## Evaluating AI

Evaluating AI is an essential component of AI literacy. Leaders must support users of AI to be critical consumers because we know that AI can perpetuate biases and incorrect information (Broussard, 2023; Buolamwini, 2023; Noble, 2018; O’Neil, 2016; Webb, 2024). If left unchecked, AI has the potential to cause harm to individuals and communities. We must constantly consider the benefits and/or costs of AI to individuals, society, and the environment. Human judgment is ultimately responsible for determining if and how it is appropriate to integrate AI outputs or predictions in our lives. The core values elaborated in the following section provide additional context and explanation of how and why to evaluate AI systems and tools.



## Core Values

Core values are overarching practices that support learners to safely and effectively evaluate AI tools. In this section, we name two core values, **Centering Human Judgment** and **Centering Justice**. To support AI literacy development, leaders have a responsibility to connect these core values to the specific applications of AI systems and tools in their unique context.



### Centering Human Judgment

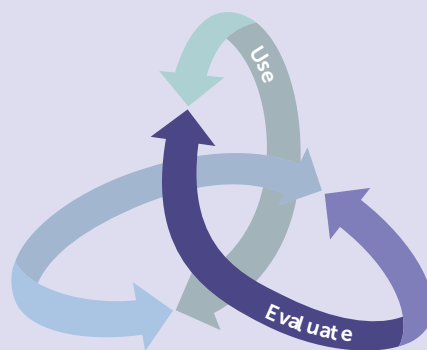
Developers design AI systems that use hardware, algorithms, and data to do things like make decisions, discover patterns, and perform actions. While AI appears to mimic human intelligence; it is not the same. Humans and computers are good at different things. Computers are very good at performing mathematical calculations quickly and following a precise set of instructions. Computers can analyze large amounts of data in order to make predictions, but the applicability of those predictions is limited to the scope of the data that was collected. Computers cannot take into account information that they do not have access to, such as context and emotions. For example, AI can’t detect human-to-human sarcasm or understand different contexts or situations. AI also does not have consciousness; it is not reflective or able to assess its actions (Huckins, 2023). Because of this, we caution against anthropomorphizing AI. We remind users that AI tools should be referred to as “it” rather than pronouns and avoid referencing GenAI errors as “hallucinations” to avoid making light of mental health issues (Ruiz & Glazer, 2024).

Our world is increasingly becoming one in which computers and humans work together to solve problems (Roschelle et al., 2021; Roschelle, 2020). **Humans have a responsibility to apply their unique skill sets to the application of AI systems and tools, including understanding complexity, handling vague or ambiguous situations, understanding context, empathizing, and ethical decision-making** (Heintz, 2022). Centering human judgment includes identifying

## 评估人工智能

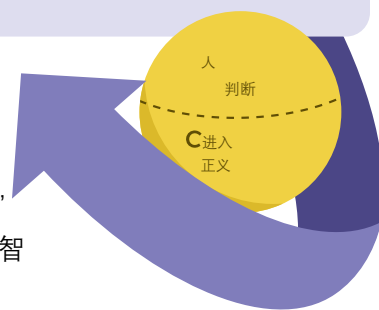
评估人工智能是提升AI素养的关键环节。领导者应当引导AI使用者保持批判性思维，因为众所周知，人工智能可能助长偏见和传播错误信息（Broussard，2023；Buolamwini，2023；Noble，2018；O’Neil，2016；Webb，2024）。若放任不管，AI可能对个人和社区造成危害。我们必须持续权衡AI对个人、社会及环境的利弊得失。最终，人类的判断力才是决定性的。

用于判断是否以及如何将人工智能（AI）输出或预测结果融入我们的生活。下文阐述的核心价值观为评估AI系统与工具提供了额外背景与解释依据，阐明了其评估方法及原因。



## 核心价值观

核心价值观是支持学习者安全有效地评估人工智能工具的总体实践。在本节中，我们将提出两个核心价值观：**以人类判断为中心**和**以正义为中心**。为促进人工智能素养发展，领导者有责任将这些核心价值观与实际应用相结合。人工智能系统与工具在特定应用场景中的独特应用背景。



### 以人类判断为中心

开发者设计的人工智能系统通过硬件、算法和数据实现决策制定、模式识别及行动执行等功能。尽管人工智能看似模仿人类智能，但二者本质不同。人类与计算机擅长不同领域：计算机擅长快速执行数学运算并严格遵循指令集，能够通过分析海量数据进行预测，但预测结果的有效性受限于数据采集范围。计算机无法处理未接触的信息，例如语境信息与情感因素。例如，AI无法识别人际间的讽刺意味或理解不同情境背景，且不具备意识能力——既无法自我反思也无法评估自身行为（Huckins，2023）。因此我们提醒用户切忌将AI拟人化，应使用“它”而非代词指代AI工具，并避免将生成式AI错误称为“幻觉”以避免轻视心理健康问题（Ruiz & Glazer，2024）。

当今世界正日益发展为计算机与人类协同解决问题的领域（Roschelle等，2021；Roschelle，2020）。人类有责任将自身独特的技能应用于人工智能系统与工具的开发中，包括理解复杂性、处理模糊或含糊情境、把握语境、共情能力以及伦理决策能力（Heintz，2022）。以人类判断为核心包括识别

appropriate tasks for computers to support and determining if and how it is appropriate to integrate outputs or predictions in our lives. Further, it considers how values, beliefs, and points of view are applied through AI-enabled systems/outputs. For example, if we continue to power our planet through fossil fuels, large AI systems will likely harm our environment through unchecked energy consumption (Dhar, 2020; Keller et al., 2024). Human judgment must weigh the benefits alongside associated costs of implementing AI systems. To ensure ethical application of AI systems and tools, it is essential that humans remain at the center of if and how we integrate artificial intelligence into any context.

## Centering Justice

AI systems are impacting the lives of nearly everyone within modern society, but their results do not equally represent the interests of all people. They can and have exacerbated existing oppression and prejudice within society. Druga et al. (2021) provided examples of biases that children identified in AI systems including race and ethnicity bias (facial recognition systems recognizing white faces with more accuracy than faces from other races), age bias (AI systems not acknowledging young voices) and gender bias (AI voice assistants using female voices enforce gender norms). One cause of this bias is the data used to train algorithms within the AI systems and tools. This data often underrepresents historically excluded communities (Benjamin, 2019; Buolamwini, 2023). Yet, fixing this disparity is not as easy as collecting more data. Efforts to do so in the past have caused more harm to communities (Hollister, 2019) and there are important ethical concerns around the digital surveillance of marginalized communities, particularly the collection of images and audio to be included within large-scale datasets without proper consent for people's data (Buolamwini, 2023). Individuals must be aware that AI can collect and use data unethically. For example training datasets sometimes come from public forums on the internet. Large language models (LLMs), such as ChatGPT, use a large amount of the written material available on the web, without accreditation or consent, leading to biased and erroneous outputs.

Another cause of bias within AI systems involves the variables, or information, included in the algorithm. For example, a model that evaluates risk based on historical data might not use race, religion, gender, or age variables, but the proxy variables used like zip code and education level can be just as discriminatory (O'Neil, 2016). The individuals that design AI systems, as well as the individuals in leadership positions to determine if and how they should be used, are disproportionately white and male (U.S. Bureau of Labor Statistics, 2024; Wachter-Boettcher, 2017). Therefore, algorithms are currently designed and implemented with a drastic lack of representation from marginalized communities, including communities of color and people with disabilities (Noble, 2018). Algorithmic bias and the harms it can cause have impacted communities in many ways. In every context in which AI is applied, there is a risk of implementing automated decision-making at scale based on AI systems which perpetuate harm. **Users must center justice while understanding, evaluating, and using AI in order to ensure that all people, particularly those who have been historically and systematically excluded, are not harmed by the use of AI** (White & Scott, 2024). This is particularly crucial within the education system as

确定计算机应支持的适宜任务，并评估在日常生活中整合输出结果或预测结果的必要性及具体方式。此外，还需考量价值观、信念体系及观点如何通过人工智能系统/输出结果得以体现。例如，若我们继续依赖化石燃料驱动地球发展，大型人工智能系统很可能因能源消耗失控而对环境造成危害（Dhar，2020；Keller等，2024）。人类决策者必须权衡实施人工智能系统所带来的效益与相关成本。为确保人工智能系统及工具的伦理应用，必须始终将人类置于核心地位——决定是否以及如何将人工智能融入各类应用场景。

## 居中正义

人工智能系统正在深刻改变现代社会中几乎所有人的生活，但其产生的影响并未平等体现所有群体的利益诉求。这些技术不仅可能加剧社会中存在的压迫与偏见，实际应用中也确实存在此类现象。Druga等人（2021年）列举了儿童在人工智能系统中发现的典型偏见案例，包括种族与民族偏见（面部识别系统对白人面孔的识别准确率显著高于其他种族）、年龄偏见（AI系统未能有效识别年轻群体声音）以及性别偏见（采用女性声音的AI语音助手强化了性别规范）。造成这些偏见的重要原因之一，是训练算法时所使用的数据存在偏差。

人工智能系统与工具所收集的数据往往未能充分反映历史上被边缘化的群体（Benjamin，2019；Buolamwini，2023）。然而，消除这种数据失衡并非简单地增加数据采集量就能实现。过去试图弥补这一差距的做法反而对社区造成了更多伤害（Hollister，2019），且围绕对边缘化群体进行数字监控存在重大伦理争议——特别是在未经充分知情同意的情况下，将图像和音频数据纳入大规模数据集的做法（Buolamwini，2023）。公众必须认识到人工智能可能以不道德的方式收集和使用数据。例如，训练数据集有时直接取自互联网公共论坛。像ChatGPT这样的大型语言模型（LLMs）在未经认证或获取用户同意的情况下，大量使用网络上的书面材料，导致输出结果存在偏见和错误。

人工智能系统中偏见的另一成因在于算法所包含的变量或信息。例如，基于历史数据评估风险的模型可能不会使用种族、宗教、性别或年龄等变量，但诸如邮政编码和教育水平等代理变量同样具有歧视性（O'Neil，2016）。设计人工智能系统的人士，

在决策是否以及如何使用算法方面，包括领导岗位在内的关键群体中，白人和男性占比过高（美国劳工统计局，2024年；Wachter-Boettcher，2017年）。因此，当前算法的设计与实施严重缺乏边缘化群体的代表性，包括有色人种社区和残障人士群体（Noble，2018年）。算法偏见及其可能造成的危害已从多方面影响着社会群体。在人工智能应用的任何场景中，都存在基于AI系统大规模实施自动化决策的风险，这些决策可能持续加剧社会不公。用户必须以正义为核心理念，在理解、评估和使用AI时保持审慎态度，确保所有人——尤其是那些长期遭受系统性排斥的群体——不会因AI应用而受到伤害（White & Scott，2024年）。这一点在教育系统中尤为重要，因为

young people are being asked to engage with AI systems without choice about what tools they may use. Teachers and leaders in learning environments must be judicious in understanding the tools they choose and how their learners, in all their variability, will be impacted.

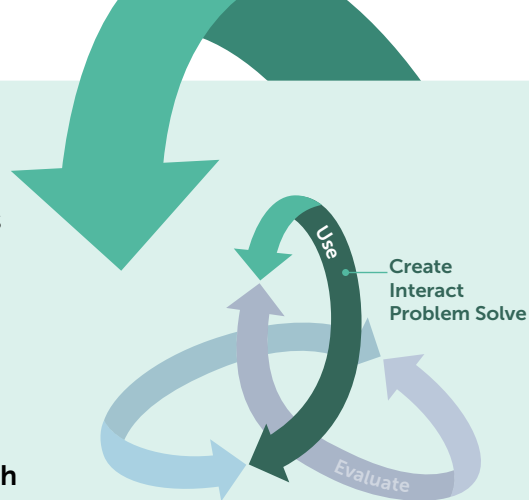
Users must constantly center these core values in any use or application of AI systems and tools. Of course, there are unique risks associated depending on the use and or context of the AI. The following section elaborates these specific risks in the final dimension of our framework, Using AI. It distinguishes between three different Types of Use: Interacting with AI, Creating with AI, and Problem Solving with A. For each type of use, it describes AI literacy practices and specifies considerations for evaluation.

年轻人正被要求在无法自主选择使用何种工具的情况下与人工智能系统互动。教育环境中的教师与领导者必须审慎评估所选工具及其对学习者的影响。

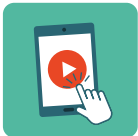


用户在使用人工智能系统和工具时，必须始终将这些核心价值观置于核心位置。当然，具体应用场景和使用情境不同，也会带来相应的独特风险。在我们框架的最终维度“人工智能应用”中，下文将详细阐述这些具体风险。该维度将应用场景划分为三种类型：与AI互动、借助AI创作、通过AI解决问题。针对每种应用场景，我们不仅详细说明了人工智能素养实践方法，还明确了评估时需要重点考量的要素。

## Using AI

Educational participants use AI for different purposes. In this section, we describe three **Types of Use**: Interacting with AI, Creating with AI, and Problem Solving with AI. **Interacting with AI** systems is engaging with adaptive technology in multiple modalities that adjusts to data collected, such as when learners use adaptive tutors in math or reading to receive content at their level of understanding. **Creating with AI** can translate or synthesize automated content, such as using tools that use LLMs to generate text. **Problem Solving with AI** is leveraging AI tools to engage in inquiry, such as decomposing problems and innovating novel automated solutions. In all of these cases, we need to apply specific skills to remain critically aware of the information they are collecting, using, and sharing in what they do. The chart below provides examples of each type of use.



**Table 4.** Description and Examples of Different Types of AI Use

Types of Use	Description	Examples
<b>Interacting with AI</b> 	Engaging with adaptive technology that adjusts to data collected	<ul style="list-style-type: none"> <li>• Scrolling through a feed on a social media platform with “recommended” posts.</li> <li>• Speaking to virtual assistants (Siri, Alexa, etc)</li> <li>• EdTech platform that personalizes learning (automate question difficulty, text-to-speech accommodation, etc.)</li> </ul>
<b>Creating with AI</b> 	Translating or synthesizing content	<ul style="list-style-type: none"> <li>• Prompting an AI-powered image animator</li> <li>• Prompting a chatbot to create synthetic text</li> <li>• Using AI to transcribe an audio file</li> <li>• Using an AI wrapper to create a chatbot</li> <li>• Generating activity-specific content (flashcards, quizzes, graphic organizers, differentiated content, etc)</li> </ul>
<b>Problem Solving with AI</b> 	Engaging in inquiry, including decomposing problems, and developing innovating solutions	<ul style="list-style-type: none"> <li>• Constructing an AI-enabled tool to address novel ways of better connecting ideas to address a real-world problem (e.g. building an image detection algorithm to clean litter or a sensor to monitor water quality)</li> <li>• Analyzing existing data to investigate problems, for instance, using AI tools to interrogate how writers with different backgrounds or perspectives might analyze a situation</li> </ul>

AI literacy requires understanding the risks inherent to each of these types of use. In the following sections we explain how AI literacy practices can be uniquely applied to each use type in order to effectively understand and evaluate AI-enabled systems and tools.

## 使用AI

教育领域的参与者会出于不同目的使用人工智能技术。本节将阐述三种应用场景：与AI互动、借助AI创作以及运用AI解决问题。与AI互动指通过多模态方式与自适应技术进行交互，该技术能根据收集的数据动态调整内容——例如学习者在数学或阅读课程中使用自适应导师系统时，系统会根据其理解水平智能推送适配内容。利用AI创作

人工智能能够翻译或合成自动化内容，例如使用基于LLM生成文本的工具。问题解决

采用人工智能技术的企业正运用AI工具开展探索性工作，例如分解问题并创新自动化解决方案。在所有这些应用场景中，我们需要运用特定技能来保持对信息收集、使用及共享过程的批判性认知。下图展示了各类应用场景的具体示例。

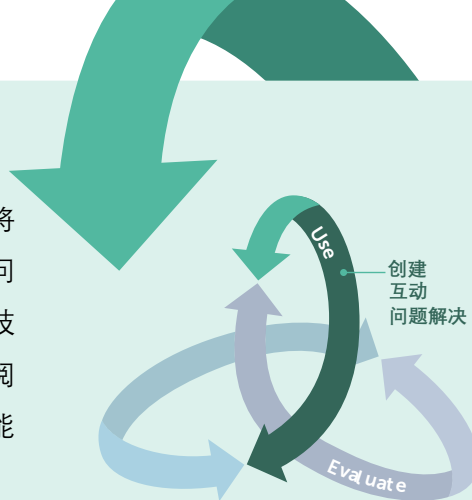


表4.不同类型人工智能应用的描述与示例

使用类型	描述	示例
 与AI互动	采用能根据收集数据进行调整的适应性技术	<ul style="list-style-type: none"><li>在社交媒体平台上浏览带有“推荐”帖子的动态内容。</li><li>与虚拟助手（Siri、Alexa等）对话</li><li>可个性化学习的教育科技平台（包括自动化问题难度设置、文本转语音适配功能等）</li></ul>
 使用 AI 创建	翻译或合成内容	<ul style="list-style-type: none"><li>启动AI图像动画器</li><li>引导聊天机器人生成合成文本</li><li>利用AI转录音频文件</li><li>利用AI封装器创建聊天机器人</li><li>生成活动专用内容（如闪卡、测验、图形组织器、差异化内容等）</li></ul>
 人工智能问题求解	开展探究活动，包括分解问题及开发创新解决方案	<ul style="list-style-type: none"><li>构建基于人工智能的工具，以探索创新方法实现思想与现实问题的有效关联（例如：开发图像检测算法用于清理垃圾，或设计传感器用于监测水质）。</li><li>通过分析现有数据来探究问题，例如运用人工智能工具分析具有不同背景或观点的作者可能如何分析某一情境。</li></ul>

掌握人工智能素养需要理解各类应用场景中固有的风险。下文将阐述如何针对不同应用场景独特地应用人工智能素养实践方法，从而有效理解和评估人工智能赋能系统与工具。









## Interacting with AI

Interacting with AI involves engaging with adaptive technology in multiple modalities that adjusts to data collected. Using these tools can make certain tasks or decisions easier. For example, suggesting songs to make your perfectly curated road trip playlist requires access to data about songs (e.g. genre, artist, tempo), as well as features of the songs that you like to listen to.

Interacting with AI often requires enabling AI tools access to personal data in order for it to automate a process or make a prediction. With regard to interacting with AI, there is a risk of personal data that is being collected or shared without consent. All too often people use AI passively without considering the privacy, safety, or societal implications of doing so. To be truly AI literate, users must take a more active approach, with critical awareness of what data the algorithm is using and how it is being applied and shared. In the table below, we connect each AI literacy practice as it relates to users interacting with AI.

Table 5. AI Literacy Practices for Interacting with AI

AI Literacy Practice	Example Application to Interacting with AI
 <b>Algorithmic Thinking, Abstraction &amp; Decomposition</b>	Understand how AI tools make automated recommendations and how to influence recommendations for specific goals.
 <b>Data Analysis &amp; Inference</b>	Identify the data that the AI model is taking into account, and how it influences recommendations.
 <b>Data Privacy &amp; Security</b>	Understand what data is being collected and shared and how to control settings that protect data privacy.
 <b>Digital Communication &amp; Expression</b>	Responsibly engage with and share AI-influenced or AI-created content online.
 <b>Ethics &amp; Impact</b>	Responsibly interact with age-appropriate tools and platforms. Be aware of the impact of consumption of AI-influenced content on self, others, and environment.
 <b>Information &amp; Mis/Disinformation</b>	Navigate the information landscape to understand what suggestions are relevant and appropriate. Fact check content the algorithms recommend. Seek information outside of "filter bubbles" which can limit exposure to different points of view.



## 与AI互动

与人工智能互动需要通过多种交互方式运用自适应技术，该技术能根据收集的数据动态调整。借助这些工具可简化特定任务或决策流程。例如，要生成精心策划的公路旅行歌单并推荐歌曲，需获取歌曲数据（如流派、歌手、节奏）以及用户偏好特征。

与人工智能交互时，通常需要授权AI工具访问个人数据，才能实现流程自动化或预测功能。在使用AI过程中，存在未经用户同意就收集或共享个人信息的风险。人们往往被动使用AI技术，却忽视了这种行为对隐私保护、安全性和社会影响的潜在风险。要真正提升AI素养，用户必须采取更主动的态度，对算法使用的数据类型及其应用共享方式保持批判性认知。下表将各AI素养实践与用户与AI交互场景进行关联分析。

表5.与AI交互时的人工智能素养实践

人工智能素养实践	人工智能交互应用实例
 <b>算法思维、抽象与分解</b>	理解人工智能工具如何生成自动化推荐结果，以及如何针对特定目标对推荐结果进行干预。
 <b>数据分析与推断</b>	识别人工智能模型所考虑的数据及其对推荐结果的影响。
 <b>数据隐私与安全</b>	了解正在收集和共享的数据类型，以及如何控制保护数据隐私的设置。
 <b>数字传播与表达</b>	负责任地参与并分享受人工智能影响或由人工智能创建的在线内容。
 <b>伦理与影响</b>	负责任地使用适合年龄阶段的工具与平台。需警惕人工智能影响内容的消费对自我、他人及环境产生的影响。
 <b>信息与错误信息/虚假信息</b>	在信息环境中进行导航，以理解哪些建议具有相关性和适宜性。对算法推荐内容进行事实核查。寻求“过滤气泡”之外的信息，以避免限制对不同观点的接触。






## Creating with AI

Generative AI platforms such as ChatGPT, Claude, Gemini, and other LLMs can generate text responses to prompts and platforms such as DALL-E can generate images. The outputs are synthetic content based on associations among billions of data points. To create an output, the person using a GenAI has to enter a prompt. The skill of GenAI prompting involves creating good questions or commands that get the system to produce something that humans consider to be a quality output. While prompting itself is a skill, it requires an understanding of the desired outputs and of how to verify and validate that those outputs are accurate. Effectively prompting a GenAI system or tool takes time and often requires clear communication, specificity, experimentation, and patience.

There are also risks associated with Creating with AI. Since data used to make predictions are historical, they may contain biases and assumptions that we do not want to perpetuate. For example if asked to generate an image of a doctor, a GenAI model might be more likely to generate a white male. There is another risk that GenAI might generate something completely wrong. LLMs have a tendency to include subtly wrong or harmfully wrong information (Webb, 2024). For this reason, GenAI systems should not be used to learn new information about that topic. LLMs are also capable of easily being used to produce nefarious outputs, such as deep fakes (Ferrara, 2024). Technological guardrails are often slow to appear or easily circumvented. Humans need to provide significant oversight about the content the LLMs are producing, particularly for vulnerable populations such as children. We remind users to check acceptable use policies before encouraging learners to directly use GenAI platforms given that many are for users ages 13 and up. After ensuring ethical use of GenAI, and verifying the synthetic product is accurate and reliable, users should cite and acknowledge use of the GenAI tool when sharing its outputs.

**Table 6.** AI Literacy Practices for Creating with AI

AI Literacy Practice	Application to Creating with AI
 <b>Algorithmic Thinking, Abstraction &amp; Decomposition</b>	Distinguish between essential and nonessential components of a prompt to produce an appropriate output.
 <b>Data Analysis &amp; Inference</b>	Identify the context and source of the dataset the AI platform was trained on.
 <b>Data Privacy &amp; Security</b>	Understand what and how data is being collected and shared by GenAI tools, and how to control settings that protect data privacy.









## 使用 AI 创建

生成式AI平台如ChatGPT、Claude、Gemini及其他大型语言模型（LLMs）能够根据提示生成文本回复，而DALL-E等平台则可生成图像。这些输出内容是基于数十亿数据点之间的关联性而生成的合成内容。要创建输出，使用生成式AI的人必须输入提示。生成式AI提示技巧涉及设计优质问题或指令，以促使系统产出人类认为高质量的输出。虽然提示本身是一项技能，但需要理解预期输出内容，并掌握如何验证和确认这些输出的准确性。有效提示生成式AI系统或工具需要时间投入，通常还需清晰沟通、具体要求、反复实验和耐心等待。

使用人工智能进行创作也存在风险。由于用于预测的数据具有历史属性，其中可能包含我们不愿延续的偏见和假设。例如，当被要求生成医生形象时，生成式AI模型可能更倾向于生成白人男性形象。另一个风险是生成式AI可能生成完全错误的内容。大语言模型（LLM）存在包含细微错误或有害错误信息的倾向（Webb，2024）。因此，不应利用生成式AI系统学习该主题的新信息。大语言模型还容易被用于生成恶意输出，例如深度伪造（Ferrara，2024）。技术防护措施往往反应迟缓或容易被规避。人类需要对大语言模型生成的内容进行严格监管，特别是针对儿童等弱势群体。我们提醒用户在鼓励学习者直接使用生成式AI平台前，务必查阅相关使用政策，因为许多平台仅限13岁以上用户使用。在确保GenAI的伦理使用并验证合成产物准确可靠后，用户在共享其输出时应引用并承认使用了GenAI工具。

表6.利用AI进行创作的人工智能素养实践

人工智能素养实践	人工智能在创作中的应用
 <b>算法思维、抽象与分解</b>	区分提示中必需与非必需组件以生成适当输出。
 <b>数据分析与推断</b>	确定人工智能平台所训练数据集的上下文及来源。
 <b>数据隐私与安全</b>	了解GenAI工具收集和共享的数据内容及方式，并掌握控制数据隐私保护设置的方法。




 <p><b>Digital Communication &amp; Expression</b></p>	<p>Recognize appropriate opportunities to use AI to create more efficiently or augment creative skill sets.</p> <p>Evaluate how generated outputs are appropriate for the audience communications/relationships (emails, birthday cards, etc).</p>
 <p><b>Ethics &amp; Impact</b></p>	<p>Consider how your creation aligns to personal values/ethics. Ensure appropriate and ethical application of synthetic content (e.g. citing appropriately, mitigating harm of deep fakes, etc). Become aware of the impact of consumption of GenAI created content on self, others, environment and society.</p>
 <p><b>Information &amp; Mis/Disinformation</b></p>	<p>Identify mis/disinformation in synthesized outputs/products. Evaluate whether you are perpetuating false information when creating (e.g. do not include mis/disinformation in prompts).</p>



## Problem Solving with AI

Problem solving with AI is using AI-enabled systems and tools to engage in inquiry, such as to decompose problems or develop innovative solutions. An example is training an algorithm for image detection, such as distinguishing between marine animals and litter as part of an automated system to clean up aquatic ecosystems (Code.org, 2024). Taking it a step further, another example is of learners in Delhi, India who applied computer science learnings to build an AI sensor boat to monitor water quality for local villagers and protect aquatic animals (Kumar, 2023).

Likewise, there are risks associated with Problem Solving with AI. Developers need to be aware that algorithms take on the biases that are already represented in the data and all data includes human biases. Therefore, evaluating the sources, contexts and organization of the training data is essential. Most of the training data available to AI systems comes from public interfaces on the internet, which is overrepresented as white and male (Buolamwini, 2023; Noble, 2018). Furthermore, the data used to train these models has often been used without the authors' or artists' consent which has created legal issues and challenges currently in litigation (Ingram, 2023). Additionally, developers must ensure ethical application of the prediction or product from the AI-enabled system. This is particularly important because with AI systems, a human may not be able to understand the rules the algorithm is creating and using to make decisions. Therefore, it's important to consider values, beliefs, and points of view when applying predictions from AI tools to make decisions. The more we understand about the data and algorithms in the AI-enabled systems we use, the better we can make decisions about if and how to use them.

 <p><b>数字传播与表达</b></p>	<p>识别适当机会运用人工智能技术，以提升工作效率或增强创意技能组合。</p> <p>评估生成的输出内容是否适用于受众沟通/关系（电子邮件、生日贺卡等）。</p>
 <p><b>伦理与影响</b></p>	<p>需考量作品与个人价值观及伦理观的契合度，确保合成内容的使用符合规范与伦理要求（如规范引用、降低深度伪造危害等）。同时应充分认识消费生成式AI内容对自我认知、他人影响、生态环境及社会发展的潜在影响。</p>
 <p><b>信息与 错误信息/虚假信息</b></p>	<p>识别合成输出/产品中的错误/虚假信息。评估在创建过程中是否传播虚假信息（例如：在提示中避免包含错误/虚假信息）。</p>



## 人工智能问题求解

人工智能问题解决是指运用AI赋能系统和工具开展探究活动，例如分解问题或开发创新解决方案。典型案例包括训练图像检测算法——以自动清理水生生态系统系统为例，该系统能有效区分海洋动物与垃圾（Code.org, 2024）。更进一步的案例可见于印度德里地区：当地学习者运用计算机科学知识，开发出AI传感船用于监测水质，既保障村民用水安全又保护水生生物（Kumar, 2023）。

同样，人工智能解决问题也存在风险。开发者需意识到算法会继承数据中已存在的偏见，而所有数据都包含人类偏见。因此，评估训练数据的来源、背景及组织结构至关重要。目前人工智能系统可获取的训练数据大多来自互联网公共接口，且数据呈现白人和男性过度代表的特征（Buolamwini, 2023; Noble, 2018）。

此外，用于训练这些模型的数据常未经作者或艺术家同意就被使用，这引发了法律纠纷并导致诉讼案件（Ingram, 2023）。开发者必须确保对人工智能系统生成的预测结果或产品进行合乎伦理的应用。这一点尤为重要，因为人工智能系统中人类可能无法理解算法制定决策时所依据的规则。因此，在应用AI工具的预测结果时，必须充分考虑价值观、信仰体系及不同观点。我们对所使用人工智能系统中的数据和算法理解越深入，就越能做出明智决策——包括是否使用这些工具以及如何使用。

Table 7. AI Literacy Practices for Problem Solving with AI







AI Literacy Practice	Application to Problem Solving with AI
 <b>Algorithmic Thinking, Abstraction &amp; Decomposition</b>	<p>Understand how to leverage large datasets to train an AI system to perform a task.</p>
 <b>Data Analysis &amp; Inference</b>	<p>Evaluate the sources, contexts, and organization of data on which the algorithm is trained.</p>
 <b>Data Privacy &amp; Security</b>	<p>Consider what personal identifiable information (PII) or sensitive data you are collecting in your approach to problem solving and how to protect user privacy and security.</p>
 <b>Digital Communication &amp; Expression</b>	<p>Understand norms and best practices to develop and share AI systems. Evaluate how the outputs of the AI-enabled system you programmed are shared and communicated to the user.</p>
 <b>Ethics &amp; Impact</b>	<p>Consider the underlying values, ethics, and intended impact of your AI tool on self, others, environment, and society. Evaluate whether the prediction or application in your algorithm is perpetuating bias.</p>
 <b>Information &amp; Mis/Disinformation</b>	<p>Identify bias and representation in the training data or incorrect results.</p>

表7.人工智能素养在问题解决中的应用实践

人工智能素养实践	人工智能在问题解决中的应用
 <b>算法思维、抽象与分解</b>	掌握如何利用大型数据集训练人工智能系统完成特定任务。
 <b>数据分析与推断</b>	评估算法训练所依据的数据来源、背景及组织结构。
 <b>数据隐私与安全</b>	请考虑您在解决问题过程中收集的个人身份信息（PII）或敏感数据，以及如何保护用户隐私和安全。
 <b>数字传播与表达</b>	理解规范与最佳实践以开发和共享人工智能系统。评估您所编程的人工智能系统输出结果如何被共享并向用户传达。
 <b>伦理与影响</b>	需考量人工智能工具对自身、他人、环境及社会层面的潜在价值、伦理影响及预期作用。评估算法中的预测或应用是否加剧了偏见现象。
 <b>信息与错误信息/虚假信息</b>	识别训练数据中的偏倚与代表性或错误结果。

# Putting It All Together

We are applying this framework to support educators and leaders in designing AI literacy learning experiences for specific audiences. The following graphic illustrates an example of the framework in action for a high school student, following a winding pathway of the three Modes of Engagement. It demonstrates how engagement in AI literacy is non-linear and intertwined, where each mode of engagement builds and strengthens on each other to foster overall AI literacy. The lesson example builds on Common Sense Media's [AI Literacy Lessons for Grades 6-12](#), specifically, Lesson 3: "AI Chatbots: Who's Behind the Screen?" (Common Sense Media, 2024b).

## AI Literacy Framework in Action: A Learning Journey for a High School Lesson

### Understand, Evaluate, and Use AI Chatbots



Algorithmic  
Thinking,  
Abstraction &  
Decomposition

#### Understand

Learn about existing AI chatbot platforms:

- **What is an AI Chatbot?**
- **How does an AI Chatbot work?**
- *Optional:* Watch this [explainer video](#) from Common Sense Media



Create

#### Use/Evaluate

Select an AI chatbot to explore:

- Responsibly tinker with prompting to create outputs.
- **Center human judgment** while using by noting a list of questions and curiosities that emerge while interacting.

#### Understand/Evaluate

Research your questions and curiosities to seek answers supported with evidence:

- **What data was used to develop this chatbot?**
- **What type of tasks can the chatbot conduct accurately and when does it generate errors?**
- **How do computer scientists and designers make AI chatbots sound human-like?**



Information &  
Mis/Disinformation



Data Analysis &  
Inference

# 整合所有要素

我们正在运用这一框架，帮助教育工作者和领导者为特定受众设计人工智能素养学习体验。下图展示了该框架在高中生教学中的应用实例，通过三个参与模式的循序渐进路径，生动呈现了人工智能素养学习过程的非线性特征与相互交织关系——各参与模式相互促进、层层递进，最终形成完整的人工智能素养培养体系。本案例以常识媒体公司[《6-12年级人工智能素养课程》](#)第三课“AI聊天机器人：屏幕背后是谁？”（常识媒体，2024b）为教学素材为基础展开说明。

## 人工智能素养框架在实践中的应用：高中课程学习之旅

### 理解、评估与应用AI聊天机器人

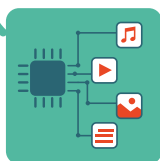


算法思维、抽象  
与分解

#### 理解

了解现有AI聊天机器人平台：

- 什么是AI聊天机器人？
- AI聊天机器人是如何工作的？
- 可选：观看来自Common Sense Media的[解释视频](#)



创建

#### 使用/评估

请选择AI聊天机器人进行探索：

- 负责任地调整提示方式以生成输出结果。
- 在使用过程中，通过记录互动时出现的问题和好奇心列表，集中人类判断力。



信息与虚假/误导性信息

#### 了解/评估

针对您的疑问与好奇心开展研究，以寻求基于证据支持的答案：

- 开发此聊天机器人的数据来源是什么？
- 聊天机器人能够准确执行哪些类型的任务？在何种情况下会产生错误？
- 计算机科学家和设计师如何让人工智能聊天机器人具备人性化音效？



数据分析与推断



Digital  
Communication  
& Expression

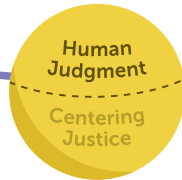
### Evaluate

**Center Human Judgment** through discussion questions for a Socratic seminar (builds off Common Sense Media [graphic organizer](#)):

- **Who does this AI chatbot sound like?** What is its language and tone?
- **Why are AI chatbots designed to sound like people?**
- **What issues might arise if AI chatbots sound just like people?**
- **What are the safety and transparency implications of datasets used for different chatbots**, especially those with the likeness of real people/historical figures?
- **Is this AI chatbot the right tool for its intended task?**



Data Privacy  
& Security



Ethics & Impact

### Evaluate

**Center Justice** by completing an **Ethics Matrix** (builds off [MIT RAISE](#)) of a specific AI Chatbot platform:

- **Who is invested in AI Chatbots?** Identify stakeholders who care about this AI chatbot application on the first column of the matrix.
- **Why do they care?** Identify the values of each stakeholder on the top row of the matrix.
- Complete the matrix to note what values apply to what stakeholder.

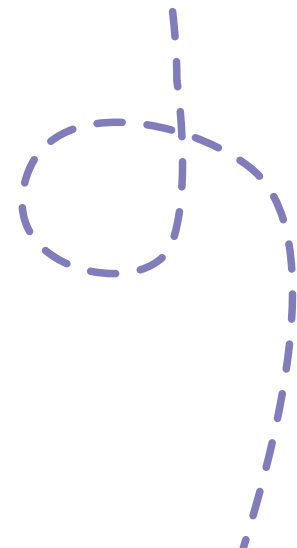
## Example Ethics Matrix

### Values

	Fun	Belonging	Mental Wellbeing	Money
Teen User	✓	✓	✓	
Parent			✓	
AI Chatbot Company				✓



Stakeholders

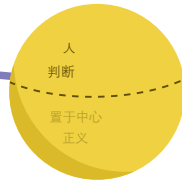




数字通信  
& 表达式



数据隐私与安全



### 评估

通过苏格拉底式研讨会中的讨论问题来培养人类判断力（构建Common Sense Media[图形组织工具](#)）：

- 这个 AI 聊天机器人听起来像谁？它的语言和语气是什么？
- 为什么人工智能聊天机器人要设计得像真人说话？
- 如果AI聊天机器人听起来和真人一模一样，可能会引发哪些问题？
- 用于不同聊天机器人的数据集（尤其是那些具有真人/历史人物外貌特征的数据集）会带来哪些安全性和透明度方面的影响？
- 这款AI聊天机器人是否适合其预期用途？

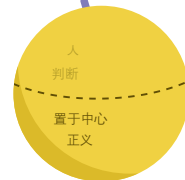


伦理与影响

### 评估

通过完成特定AI聊天机器人平台的伦理矩阵（[MIT的版本会提升](#)）来实现中心正义：

- 谁在投资AI聊天机器人？在矩阵的第一列中识别出关心该AI聊天机器人应用的利益相关者。
- 他们为什么关心？在矩阵的顶部行中确定每个利益相关者的价值。
- 完成矩阵以记录哪些数值适用于哪些利益相关者。

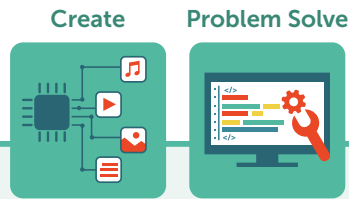


### 示例伦理矩阵价值观

	趣	归属感	精神健康状况	金钱
青少年用户	✓	✓	✓	
父亲			✓	
AI聊天机器人公司				✓

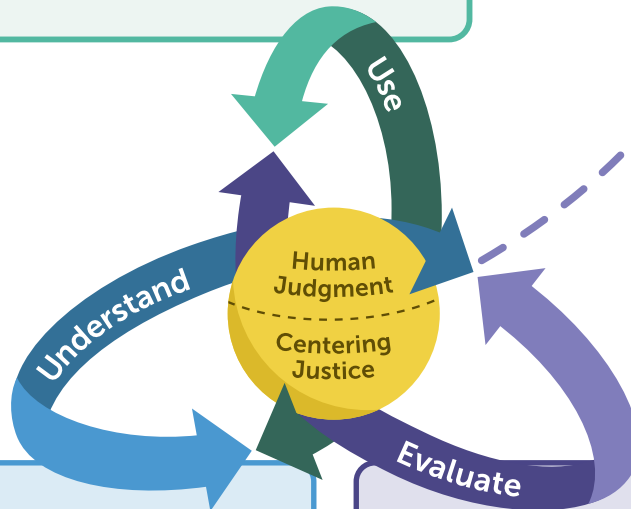
利益相关方

# Putting It All Together



**How does understanding and evaluating AI chatbots shift the way you use them?**

*Optional:* Take it a step further and apply your learnings. Use a platform such as [MIT App Inventor](#), [Playlab.ai](#), etc. to design a chatbot that helps solve a problem in your community.



How has creating, problem solving, and evaluating AI chatbots **deepened your understanding** of its affordances and limitations?



**Algorithmic Thinking, Abstraction & Decomposition**



**Data Privacy & Security**



**Ethics & Impact**



**Digital Communication Mis/Disinformation & Expression**



**Information & Mis/Disinformation**



**Data Analysis & Inference**

How has using and understanding AI chatbots **enhanced evaluation** practices while centering human judgment and justice?

How can you engage with AI chatbots in a way that aligns to your personal values/ethics?

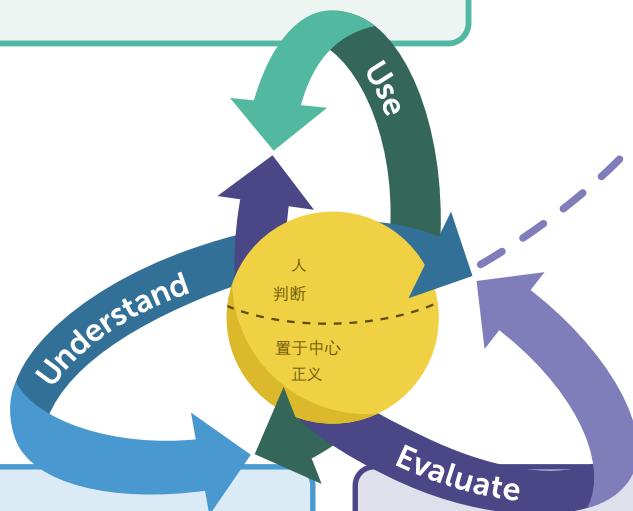
While this example helps us to understand what a learning experience for AI literacy could look like in high school, there are systems-level policies and structures that will enable these learning experiences to occur. In the second part of this paper, we identify five strategies for systems leaders to promote AI literacy in K–12 education: providing guidance for adoption and evaluation, integrating AI literacy across grades and subject-area learning, facilitating professional learning, designing powerful learning experiences, and promoting awareness and agency.

## 整合所有要素



如何通过理解和评估AI聊天机器人来改变您的使用方式？

可选：更进一步，应用你的学习成果。使用[MIT App Inventor](#)、[Playlab.ai](#)等平台设计一个聊天机器人，帮助解决你所在社区的问题。



创建、解决问题和评估人工智能聊天机器人如何加深了你对其功能和局限性的理解？



算法思维、抽象与分解



数据隐私与安全



伦理与影响



数字的  
沟通与表达



信息与虚假/误导性信息



数据分析与推断

在以人类判断和正义为中心的情况下，如何利用和理解人工智能聊天机器人来加强评估实践？

如何与AI聊天机器人互动时，才能与您的个人价值观和道德准则保持一致？

虽然这个案例有助于我们理解高中阶段人工智能素养学习体验的雏形，但真正推动这类学习实践落地的，是系统层面的政策框架与组织架构。在本文第二部分中，我们为教育系统领导者提出了五项关键策略：提供技术应用与效果评估指导、跨年级跨学科整合人工智能素养教育、构建专业能力提升机制、设计高效学习体验方案、以及增强公众认知与自主参与意识。

# Strategies to Promote AI Literacy in K–12 Education

AI literacy has emerged as a skill set for everyone to safely and ethically participate in an increasingly digital world. Public schools have a critical role to integrate AI literacy throughout K–12 education so that our current and future communities are aware and able to critically evaluate AI systems. Our AI Literacy Framework provides guidance on how leaders can design AI literacy programs so that users can safely and effectively use, understand, and evaluate AI tools in their contexts. This section identifies five strategies to promote AI literacy in K–12 education, and provides examples and guidance for implementing each strategy.

## Strategy 1: Provide Guidance for Adoption and Evaluation

### Systems Leaders and Policymakers

There is a need for policymakers and school leaders, in partnership with educators, students, and families, to develop guidance for the adoption and evaluation of AI tools in K–12 education. This guidance is a pressing need for educators and families as many AI tools are purposefully trying to market directly to teachers and bypass their administrators (Oakes, 2021). There are several factors to consider when choosing to adopt or use an AI system or tool, including accessibility and equity, data ownership and privacy, transparency, and impact. Digital Promise, with funding from the [U.S. National Science Foundation](#) along with educational leaders, technology specialists, teachers, students, and families co-designed an Emerging Technology Adoption Framework for PK–12 Education that provides guidance for informed evaluations and procurement decisions including the initial evaluation of tools, as well as factors to consider as tools as adopted and used (Ruiz et al., 2022).

In developing acceptable use policies for adoption and evaluation, leaders should consider the following:

- **Inclusivity.** Elevate the needs, interest, and voice of marginalized communities in the development of policy and guidance in order to ensure AI tools are accessible to all students and do not perpetuate harmful biases. Support policies and programs that promote digital equity and accessibility through initiatives that impact access, affordability, and adoption (Weaver, 2022).
- **Adaptability.** There are new platforms for AI systems and tools emerging everyday. Guidance should be adaptable in order to be responsive to the risks of new applications as they arise. Additionally, AI systems and tools are being used across environments. While

# 促进K-12教育中人工智能素养的策略

人工智能素养已成为每个人在日益数字化的世界中安全、合乎伦理参与社会的关键技能。公立学校肩负着将人工智能素养贯穿K-12教育体系的重要使命，这有助于当代及未来社区成员提升对人工智能系统的认知能力，并培养其批判性评估能力。我们的《人工智能素养框架》为教育领导者提供了指导方案，帮助设计人工智能素养课程，使用户能够在具体情境中安全、高效地使用、理解并评估人工智能工具。本节将提出五项K-12教育领域推广人工智能素养的策略，并附有实施案例与操作指南。

## 策略1：提供采纳与评估指导

### 系统领导者与政策制定者

政策制定者与学校管理者需要携手教育工作者、学生及家庭，共同制定K-12教育领域人工智能工具的采用与评估指南。这一指导文件对教育工作者和家庭而言至关重要，因为许多人工智能工具正试图直接面向教师进行营销推广，绕过学校管理层（Oakes，2021）。在选择采用或使用人工智能系统时，需综合考量可及性与公平性、数据所有权与隐私保护、透明度及影响效果等多重因素。由[美国国家科学基金会](#)资助的“数字承诺”项目联合教育领导者、技术专家、师生及家庭，共同设计了面向基础教育阶段的新兴技术采纳框架，该框架为工具的评估决策提供指导，涵盖初始评估环节，同时明确了工具投入使用后的关键考量要素（Ruiz等，2022）。

在制定可接受的采用与评估使用政策时，领导者应考虑以下因素：

- **包容性。**在政策制定和指导过程中提升边缘化群体的需求、兴趣和话语权，以确保人工智能工具对所有学生均能使用且不会延续有害偏见。通过影响获取途径、可负担性和应用普及度的举措，支持促进数字公平与可及性的政策和项目（Weaver，2022）。
- **适应性。**每天都有新的人工智能系统和工具平台出现。

该指南应具备适应性，以便及时应对新应用出现的风险。此外，人工智能系统和工具正被广泛应用于各类环境。

school systems have control over the technology that they provide, they have much less control over the technology that students bring to school, use outside of school programs, or use at home. Responsible use guidelines and policies should promote responsible use across contexts, both at school and outside of school.

- **Impact.** Understand the impacts of integrating AI systems and tools in learning environments, including safety and equity across students of different backgrounds, abilities, and demographics. Take a careful approach, go at a pace where you can ensure that technology adoption does not harm students in your charge or their communities.
- **Awareness, Agency, and Transparency.** School districts should require usable platforms and features that promote individual awareness of data ownership and privacy, as well agency to opt-out. Chief Information and Technology Officers have made progress in managing data privacy and security risks and these policies should remain agile as new technologies and platforms continue to emerge.

## Iowa City Community School District Provides Guidance for Teachers and Students

Iowa City Community School District is developing AI responsible use guidelines for teachers and students. They currently have several GenAI tools available for teachers to use, and a subset of GenAI tools available for high school students.

To develop responsible use guidelines for their district, they established a working group of district leaders, school leaders, and teachers. Inviting educators to be on the committee was central to their responsive approach, rooted in what the teachers need.

The group explored tools, engaged in discussions around safe, ethical, and responsible use, and provided feedback on multiple drafts of responsible use guidelines for teachers and students. The final draft includes definitions, permitted uses of AI, prohibited uses of AI, responsibilities of students and staff, response to violations, and special considerations such as transparency and communication.

In addition to the Responsible Use Guidelines, the AI working group drafted teacher and student guidelines, pictured below. These documents are intended to be posted in classrooms for quick uptake and reminders about responsible use. They summarize what students need to be mindful of when using AI for learning, and what teachers need to consider when leveraging AI for instructional design.

Figure 7. Guidance for Teachers and Students to use AI from Iowa City Community School District.



学校系统对其提供的技术设备拥有控制权，但对于学生自带至校的技术设备、课外项目中使用的技术设备或家庭中使用的设备，其控制权则有限。应制定负责任使用指南与政策，以促进学

- **影响。**了解在学习环境中整合人工智能系统和工具的影响，包括对不同背景、能力和人口统计学的学生的安全和公平。采取谨慎的方法，以确保技术采用不会损害你所负责的学生或他们的社区。
- **意识、自主权与透明度。**学区应提供实用平台和功能，帮助个人明确数据所有权与隐私权，并赋予自主选择退出的权利。首席信息与技术官在数据隐私与安全风险管控方面已取得进展，随着新技术与平台的持续涌现，相关政策应保持灵活应变。

## 爱荷华市社区学区为教师与学生提供指导

爱荷华市社区学区正在为教师和学生制定人工智能负责任使用指南。

目前，他们为教师提供了多种通用人工智能工具，为高中生提供了一部分通用人工智能工具。

为制定本辖区负责任使用指南，他们成立了由辖区领导、学校负责人及教师组成的工作组。邀请教育工作者参与委员会是其响应式方法的核心要素，该方法基于教师的实际需求而建立。

该小组深入探讨了相关工具，围绕安全、伦理及负责任使用原则展开讨论，并针对教师与学生版负责任使用指南的多份草案提供了反馈意见。最终定稿包含以下内容：人工智能的定义、允许使用场景、禁止使用情形、师生责任划分、违规处理措施，以及透明度与沟通机制等特殊考量因素。

除《负责任使用指南》外，人工智能工作组还制定了教师与学生使用指南（见下图）。这些文件拟张贴于教室，便于快速落实并提醒师生注意负责任使用。指南总结了学生在学习中使用人工智能时需注意的事项，以及教师在教学设计中运用人工智能时应考虑的因素。

图7.爱荷华市社区学区教师与学生使用人工智能的指导文件。



In the future, Iowa City plans to share the responsible use guidelines districtwide, and align them with the academic code of conduct and board policies. They are also planning to provide foundational learning for teachers, establish a scope and sequence for equipping students with the knowledge to stay safe when using AI tools, and identify one teacher from each building to champion the work, providing just-in-time learning to colleagues and co-designing examples of generative AI in lesson planning, differentiation, and feedback/assessment.

## Strategy 2: Integrate AI Literacy Across Grades and Subject-Area Learning

### System and School Administrators

It is essential that educators integrate AI literacy within the topics they already teach, such as math and ELA. While library media and computer science courses are certainly programs that can build AI literacy foundational skills and technical knowledge, integrating AI literacy across subject area learning enables students to experience the cross-disciplinary application of AI tools. Integrating AI literacy across disciplines is advantageous for several reasons. One is that library media and computer science courses are typically elective courses which are not mandated for all students. Computer science courses also disproportionately enroll white males (Code.org et al., 2023). In order to promote AI literacy for all students, particularly females and students of color, it is essential to integrate AI Literacy Practices into core subject areas like math and ELA. Another reason to integrate AI literacy across subjects is to realize its potential to introduce novel teaching strategies and enhance learning. For instance, students can learn about homonyms in English Language Arts by using and evaluating text-to-speech systems. If complementary integration points are identified, AI literacy can become a value-add to disciplinary learning and not an add-on to an already overscheduled school day. Finally, cross-disciplinary integration of AI literacy enables students to make connections to cross-sector application of AI, which is relevant to their career and workforce awareness and preparation.

We also recommend that AI literacy skills should be integrated cumulatively throughout grades K–12. In the younger grades, students should build foundational skills without necessarily using AI-enabled tools themselves. For example, students might study probability in math and describe patterns and relationships in the data. They could develop a program in Scratch (Algorithmic Thinking, Abstraction and Decomposition) and determine the implications of sharing their program within the Scratch community (Data Privacy and Security; Digital Communication & Expression). They could also collect data in science or social studies classes and discuss what the sample includes and does not include (Data Analysis & Inference). In fact, because AI literacy is so dependent on the existing initiatives described earlier, some of these sorts of lessons are likely already taking place in many schools within initiatives already dedicated to media literacy, digital citizenship, and computational thinking. Building these foundational skills is essential to prepare students to engage critically with AI tools when developmentally appropriate. We can build

未来，爱荷华市计划在全市范围内推广负责任使用指南，并将其与学术行为准则及校董会政策保持一致。该市还计划为教师提供基础培训，制定系统化教学方案帮助学生掌握使用人工智能工具时的安全知识，同时从各校选拔教师担任示范角色，通过即时学习支持同事，并共同设计生成式AI在课程规划、差异化教学及反馈评估中的应用案例。

## 策略二：跨年级与跨学科融合人工智能素养教育

### 系统与学校管理者

教育工作者必须将人工智能素养融入现有教学科目，例如数学和英语语言艺术课程。虽然图书馆媒体与计算机科学课程确实能培养人工智能素养的基础技能和技术知识，但通过跨学科教学整合人工智能素养，能让学生亲身体验AI工具的跨领域应用。这种跨学科融合具有多重优势：首先，图书馆媒体与计算机科学课程多为选修课，并非所有学生必修；其次，计算机科学课程的注册学生中白人男性占比过高（Code.org等，2023）。为促进全体学生（尤其是女生和少数族裔学生）掌握人工智能素养，必须将AI素养实践融入数学和英语语言艺术等核心学科。此外，跨学科融合还能释放其潜力，引入创新教学策略并提升学习效果。例如，学生可通过使用文本转语音系统学习英语语言艺术中的同音词知识，并进行实际应用评估。若能发现互补性整合点，人工智能素养将能为学科学习创造附加价值，而非对已排满课表的学校日程造成额外负担。最终，跨学科整合人工智能素养可帮助学生建立跨领域应用的关联，这对他们的职业规划和职场认知准备具有重要意义。

我们建议人工智能素养培养应贯穿K-12全学段进行系统性整合。在低年级阶段，学生无需直接使用AI工具即可掌握基础技能。例如，学生可通过数学课程学习概率理论，分析数据中的规律与关联；运用Scratch编程语言（算法思维、抽象化与分解能力）开发程序，并探讨在Scratch社区分享代码的影响（数据隐私与安全、数字沟通与表达）；在科学或社会研究课中收集数据样本，讨论样本包含与遗漏要素（数据分析与推断能力）。事实上，由于人工智能素养的培养高度依赖前文所述教育项目，许多学校已在开展媒体素养、数字公民教育及计算思维相关课程时自然融入了此类教学内容。构建这些基础技能对培养学生在适龄阶段批判性运用AI工具的能力至关重要。我们可以通过

from well-established bodies of work that support our understanding of learning progressions for these foundational skills (Rich et al., 2017, Rich et al., 2018, Rich et al., 2019) and strategies to integrate them across disciplines and content areas (Mills et al., 2024).

There is no straightforward answer to what age or grade is most appropriate to integrate AI systems or tools. The minimum age that federal law states that students can create their own digital accounts is 13 years, however this depends on the system and not all tools require account creation or some tools might be used by students under a teacher or guardian’s account. We suggest educators take a nuanced approach to integrating AI tools in learning environments depending on the students developmental milestones, cognitive readiness, the context and the purpose of use. Additionally, educators should ensure that students’ personal data is protected, provide guidance and oversight about how to remain critically conscious of its use and implications, and communicate about how they are using the tools with parents and caregivers.

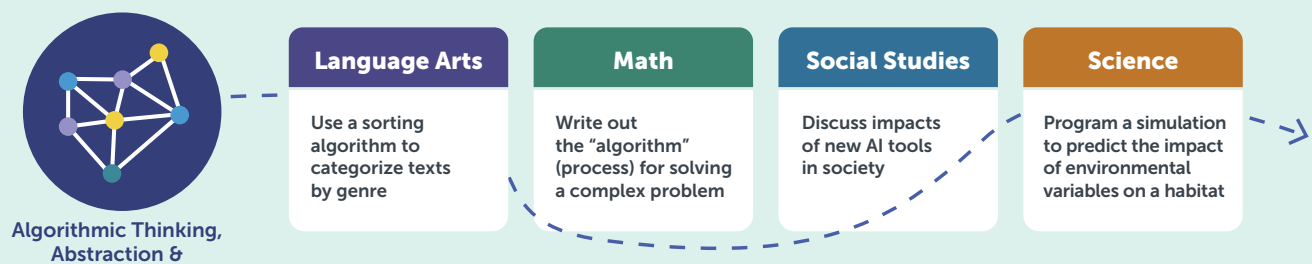
## Talladega County Public Schools Designs K–12 Learning Pathways for AI Literacy

**Talladega County Public Schools** has designed and implemented K–12 cumulative, consistent and competency based integrated learning experiences for computational thinking. Their CT pathway was developed by teachers from each grade level in alignment with Alabama Digital Literacy and Computer Science Standards. Talladega continues to expand on their CT pathway, and is now engaging teachers to design learning experiences that specifically integrate AI literacy.

Learn more about:

- [Designing K–12 Learning Pathways](#)
- [Talladega County’s Computational Thinking pathway](#)

**Figure 8.** Example of a Learning Pathway Integrating Algorithmic Thinking, an AI Literacy Practice Across Subject Areas in Middle School



这些成果源自权威研究体系，这些体系不仅深化了我们对基础技能学习进程的理解（Rich等，2017；Rich等，2018；Rich等，2019），还提出了跨学科与跨领域整合这些技能的策略（Mills等，2024）。

关于人工智能系统或工具最适合在哪个年龄段或年级引入，目前尚无明确答案。根据联邦法律规定，学生创建个人数字账户的最低年龄为13岁，但具体要求因系统而异——并非所有工具都要求独立账户，部分工具可能由教师或监护人账户授权使用。我们建议教育工作者在教学环境中引入AI工具时，需根据学生的发展阶段、认知准备度、使用场景及教育目标采取差异化策略。此外，教育者应确保学生个人数据安全防护到位，指导学生保持对数据使用及其潜在影响的批判性思考，并与家长及监护人充分沟通工具使用情况。

## 塔拉迪加县公立学校设计人工智能素养K-12学习路径

塔拉迪加县公立学校为计算思维能力设计并实施了涵盖K-12年级的累积性、连贯性且基于核心素养的整合式学习方案。该校的计算思维培养路径由各年级教师根据阿拉巴马州数字素养与计算机科学标准共同开发。目前塔拉迪加县正持续完善该培养路径，并邀请教师团队专门设计融入人工智能素养的特色学习体验。

了解更多关于：

- [K-12学习路径设计](#)
- [塔拉迪加县计算思维路径](#)

图8. 中学跨学科融合算法思维与人工智能素养实践的学习路径示例



## Strategy 3: Facilitate Ongoing, Just-In-Time Professional Learning

### Instructional Leaders

Safe and effective integration of AI tools in education depends on AI literate teachers. However, it is not reasonable to assume that teachers will learn how to use, understand, and evaluate AI tools on their own. Professional learning aimed at enhancing AI literacy can support teachers to understand how to promote AI literacy skill development. AI literacy for teachers is two-fold. Teachers need to be literate in using AI tools for both teaching and learning. For teaching, they may focus on lesson planning, smart content creation, or grading. A focus on learning includes facilitating powerful learning experiences that promote students to develop AI literacy skills, as well as scaffolding and supporting students to leverage AI tools for learning. AI can only be used ethically and effectively in teaching and learning if teachers are literate in its use.

A challenge to providing professional learning for integrating emerging technologies such as GenAI is that new tools and platforms are constantly evolving, along with teachers' support needs. In working with districts from across the country, Digital Promise has found that districts are designing professional learning structures that are responsive to these needs, expanding beyond traditional workshops. These professional learning ecosystems leverage existing systems and structures, are sustained, provide point people, and include wrap-around supports (Coenraad et al., 2024). We elaborate on examples and strategies that specific districts are using below.

### Districts Support Teachers to Integrate AI Literacy

**Broward County Public Schools** has integrated AI literacy workshops into existing professional learning opportunities for teachers. In these workshops, teachers learn what AI is, discuss ethics and explore lessons that can be done in different subject areas and grade levels. They engage in hands-on learning opportunities to develop AI literacy skills (both plugged and unplugged). Teachers work collaboratively to draft an AI Bill of Rights (e.g. EngageAI Bill of Rights Task Force, 2024) to guide best practices for AI in teaching and learning. Finally, they collaboratively design lessons that integrate AI tools into their classrooms, with just-in-time support from expert facilitators.

To remain responsive to the emerging AI-enabled platforms, and the affordances and risks of each, Broward and other districts are expanding professional learning systems beyond traditional workshop-based approaches (Coenraad et al., 2024). Below, we identify several examples of teacher support that supplement traditional workshops, are sustained over time, and offer just-in-time support for teachers.



**Curated Teaching Resources.** In Broward County Public Schools, the STEM+CS program provides **a suite of curated resources** that have been reviewed and are regularly updated by district staff for teachers and school leaders, eliminating the barrier of finding materials to integrate AI literacy.

## 策略3：促进持续性、即时性专业学习

### 教学领导者

人工智能工具在教育领域的安全有效应用，关键在于教师是否具备AI素养。然而，若简单假设教师能自主掌握AI工具的使用、理解与评估能力，则缺乏合理性。旨在提升AI素养的专业培训，可帮助教师掌握促进AI素养技能发展的方法。教师的AI素养包含双重维度：既要精通教学与学习场景中的AI工具应用（如教案设计、智能内容创作、评分系统等），也要注重学习过程中的引导——既要通过设计高效学习体验培养学生的AI素养能力，还需搭建学习支架并支持学生善用AI工具进行学习。只有当教师真正掌握AI应用能力时，才能确保其在教学实践中实现伦理合规且高效的应用。

为整合GenAI等新兴技术提供专业培训面临的主要挑战在于：新型工具平台持续迭代更新，教师支持需求也随之变化。通过与全美各地学区的合作实践，数字承诺组织发现各学区正在构建适应这些需求的专业培训体系，突破传统研讨会模式进行拓展。这些专业培训生态系统充分利用现有系统架构，具备可持续性、配备专职协调人员，并包含全方位支持服务（Coenraad 等，2024）。下文将具体阐述各学区采用的实践案例与策略。

### 区级支持教师开展人工智能素养融合教学

布劳沃德县公立学校将人工智能素养培训课程融入教师现有的专业发展体系。在这些培训中，教师们系统学习人工智能概念、探讨伦理问题，并探索不同学科领域及年级阶段可实施的教学方案。通过实践操作环节，教师们系统培养人工智能素养能力（包括有线与无线应用场景）。教师团队协作起草《人工智能权利法案》（如EngageAI权利法案工作组2024年版本），为教学实践中的人工智能应用制定最佳实践指南。最终，教师们在专家指导者的即时支持下，共同设计将人工智能工具融入课堂教学的课程方案。

为持续适应新兴的人工智能平台及其带来的机遇与风险，布劳沃德学区及其他学区正将专业培训体系拓展至传统研讨会模式之外（Coenraad 等，2024）。下文列举若干补充传统研讨会的教师支持案例，这些案例具有长期持续性，并能为教师提供即时支持。



**精选教学资源。**在布劳沃德县公立学校，STEM+CS项目为教师和学校领导提供一套精选资源，这些资源经过审查并由学区工作人员定期更新，消除了寻找整合人工智能素养材料的障碍。



**School-Based Champion.** Talladega County Schools and Iowa City Community School District both leverage a **champion within each school** as point-people that advocate for and lead the effort of AI literacy within the school building.



**Content and Grade Alike Collaborators.** North Salem Central School District is leveraging their context as a small district to support districtwide professional learning across grade levels and content areas so **teachers can turn to each other as partners and collaborators.**

## Strategy 4: Design Powerful Learning Experiences

### Teachers and Instructional Leaders

Technology for learning is enacted through a pedagogical lens (Mishra & Koehler, 2006), and AI is no exception. That is, technology can be used in ways that promote critical thinking, exploration and creative expression. In the case of AI, this might include leveraging a LLM such as ChatGPT to brainstorm ideas. On the contrary, AI can also be used for skill and drill exercises or standardized assessment. For instance, algorithms are commonly used for individualizing recommendations of standardized learning content on computers. We support the recommendations from the National Education Technology Plan to integrate technology, such as AI, in ways that promote critical thinking, collaboration, creativity, and communication in order to close the digital use divide (U.S. Department of Education, 2024).

If used in this way, AI tools have the potential to promote Powerful Learning experiences (Digital Promise, 2024). Powerful Learning experiences are:

**Personal and Accessible**

**Authentic and Challenging**

**Collaborative and Connected**

**Inquisitive and Reflective**

Powerful learning experiences integrate AI tools in ways that promote learner-agency, open-ended problem solving and human connection (Resnick, 2024). Learning sciences research provides a valuable lens through which to understand how AI-enabled tools can promote powerful learning, taking into account a social, collaborative view of learning in ways not always measured by typical tests (Fusco et al., 2020). Learning sciences can help us understand how AI tools should scaffold or enhance a learner's ability to engage in critical thinking, creativity, collaboration, and creativity, and not replace or hinder it.

Educators should scaffold students to understand and critically evaluate AI tools everytime they are integrated into learning environments. For example, a lesson may require that a student pulls from personal experience or emotional intelligence to edit a response from a GenAI system,



**校内倡导者。**塔拉迪加县学校和爱荷华市社区学区都利用**每所学校内的倡导者**作为联络人，在校内倡导和领导人工智能素养工作。



**内容与A级合作教师。**北塞勒姆中央学区利用其小规模学区的优势，支持全学区各年级和各学科领域的专业学习，使**教师能够彼此作为合作伙伴和合作者**。

## 策略4：设计高效学习体验

### 教师与教学领导者

学习技术的应用需通过教育学视角进行考量（Mishra & Koehler, 2006），人工智能也不例外。具体而言，技术手段可被用于培养批判性思维、激发探索欲及促进创造性表达。以人工智能为例，可借助ChatGPT等大型语言模型进行头脑风暴。反之，人工智能也可用于技能训练、机械练习或标准化评估。例如，算法常被用于计算机系统中个性化推荐标准化学习内容。我们支持《国家教育技术计划》提出的建议，主张通过整合人工智能等技术手段来培养批判性思维、协作能力、创造力及沟通技巧，从而缩小数字鸿沟（美国教育部，2024年）。

若以这种方式使用，人工智能工具具有促进高效学习体验的潜力（Digital Promise, 2024年）。高效学习体验包括：

个人化与可及性

真实且富有挑战性

协作与互联

求知与反思

高效的学习体验通过整合人工智能工具，促进学习者主体性、开放式问题解决和人际互动（Resnick, 2024）。学习科学研究为我们提供了重要视角，帮助理解人工智能工具如何促进高效学习——这种视角以社会协作视角看待学习过程，其价值往往无法通过传统测试衡量（Fusco等，2020）。学习科学能帮助我们理解：人工智能工具应当如何搭建或增强学习者批判性思维、创造力、协作能力等核心素养，而非取代或阻碍这些能力的发展。

教育工作者应引导学生在人工智能工具融入教学环境时，培养其理解和批判性评估能力。例如，某课程可能要求学生运用个人经验或情商，对生成式AI系统的回复进行编辑。

which would inherently require the student to evaluate the output. Druga et al. (2021) discovered that one way that children can engage in critical awareness of AI is by trying to “trick the AI.” For instance, they drew nonsense images to “trick” image recognition systems and wore masks to “trick” facial recognition systems. Tricking the system reveals flaws and biases of the designers. Users can evaluate what the designers valued and what they ignored. Designing lessons in this way also alleviates concerns about misconduct with AI tools, such as plagiarism or inappropriately using the technology to learn new ideas, which could be fraught with misinformation. We elaborate a more specific example of what this could look like in classroom practice below.

The expectation, however, is that each of these designs and implementations will differ slightly due to the variance of context and student needs within and between classrooms. With that variance in mind, it is important for policy to position the teacher, who is the context expert, in a way that allows them to design safely for their particular students. Teacher expertise should be leveraged to fine tune broader implementation of AI tools for teaching and learning, and district policy and procedure should facilitate that.

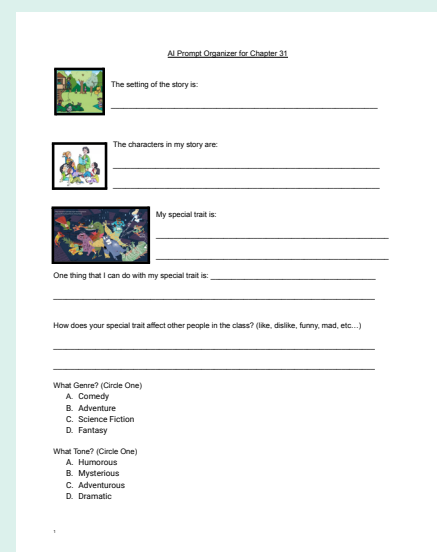
## Special Education Class Leveraging AI Tools to Scaffold Writing

Mr. Matthew Jones, a middle school teacher in the Suffern Central School District, leveraged ChatGPT in his Foundations classroom—a program with a particular focus on core academic skills for students with Individualized Education Plans (IEPs) that are significantly below grade level. The objective of the lesson was to support reading and writing skills by internalizing key elements of a story (e.g. character, setting, plot, genre, tone, etc.). Prior to this activity, students practiced this skill by identifying key elements in short stories. The next step was for students to apply their learning by generating their own story elements.

Inspired by a short story they read in class, students were prompted to create their own story adding a superpower of their choice. They used an “AI Prompt Organizer” which the teacher input into ChatGPT, while removing any personally identifiable data, asking it to generate a story using the details the students brainstormed. The students then practiced reading fluency, excited to recite a story about their own ideas, and analyzed the output to edit. To further build on this lesson, next year students will draw pictures of their story and animate it using an AI image animator.

This use-case allowed for scaffolded support of writing instruction, especially given students in this class often struggled with the stamina to construct passages. Mr. Jones explained, “Due to the nature of the students in a 12:1:1 class, being able to write full stories for themselves is a goal that would take many, many weeks or months of writing and revision. It is a task that would have consumed an entire quarter

Figure 9. AI prompt organizer to scaffold story creation with GenAI in a Special Education class.



The image shows a worksheet titled "AI Prompt Organizer for Chapter 31". It contains several sections for students to fill out:

- The setting of the story is:** A small illustration of a landscape with a house and trees is shown next to a blank line.
- The characters in my story are:** A small illustration of a group of people is shown next to a blank line.
- My special trait is:** A small illustration of a superhero is shown next to a blank line.
- One thing that I can do with my special trait is:** A blank line.
- How does your special trait affect other people in the class? (like, dislike, funny, mad, etc...)** A blank line.
- What Genre? (Circle One)**
  - A. Comedy
  - B. Adventure
  - C. Science Fiction
  - D. Fantasy
- What Tone? (Circle One)**
  - A. Humorous
  - B. Mysterious
  - C. Adventurous
  - D. Dramatic

这种教学方式本质上要求学生对输出结果进行评估。Druga 等人（2021年）发现，儿童培养对人工智能批判性认知的一种方式是通过尝试“欺骗AI”。例如，他们通过绘制无意义图像来“欺骗”图像识别系统，或佩戴面具来“欺骗”面部识别系统。这种欺骗行为能暴露设计者的缺陷与偏见，帮助用户评估设计者重视哪些要素、忽视哪些细节。采用这种方式设计课程还能缓解人们对AI工具滥用行为的担忧，比如抄袭行为或不当利用技术获取新观点（这些过程可能充斥着错误信息）。下文将通过具体课堂实践案例详细说明这种教学模式的应用场景。

不过需要指出的是，由于不同课堂内部及不同班级间存在教学情境差异和学生需求差异，这些设计方案与实施方案都会存在细微差别。基于这种差异性，教育政策制定者应当将教师——作为情境专家——置于能够为其特定学生群体设计安全教学方案的位置。应充分发挥教师的专业优势，对人工智能教学工具的广泛应用进行精细化调整，同时学区政策与操作流程也需为此提供支持保障。

## 特殊教育班级利用AI工具搭建写作支架

苏芬中央学区中学教师马修·琼斯先生在基础课程课堂中运用ChatGPT教学工具。该课程专为个别化教育计划（IEP）学生设计，重点培养其核心学术能力——这些学生的学业水平普遍低于同年级标准。本次教学旨在通过帮助学生掌握故事关键要素（如人物形象、场景设定、情节发展、文学体裁、叙事基调等），来提升阅读与写作能力。在正式教学前，学生们已通过分析短篇小说练习了要素识别技巧。后续教学环节将引导学生...  
通过自主构建故事元素来运用所学知识。

受课堂上阅读的一篇短篇小说启发，学生们被要求创作属于自己的故事，并赋予他们自选的超能力。教师使用“AI提示生成器”将内容输入ChatGPT，同时移除所有个人身份信息，要求系统根据学生头脑风暴的细节生成故事。随后学生们进行了朗读练习。学生们流利地复述了关于自身想法的故事，并对输出内容进行了分析以进行编辑。为进一步深化本课程内容，明年学生将绘制故事插图，并利用AI图像动画工具将其制作成动画。

这种教学场景为写作教学提供了阶梯式支持，尤其考虑到该班级学生普遍缺乏持续完成段落写作的耐力。琼斯先生解释道：“由于12:1:1班级的学生构成特点，要让学生独立完成完整故事的写作需要耗费数周甚至数月的时间进行写作与修改。这项任务原本足以占用整个季度的教学时间。”

图9.人工智能提示组织器在特殊教育课堂中通过生成式AI辅助构建故事创作框架。

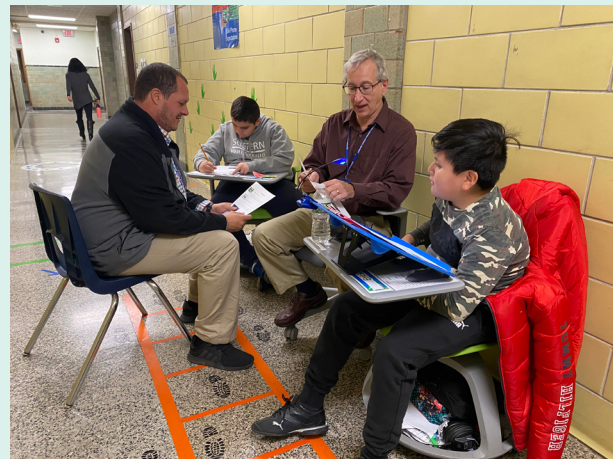
The image shows a digital form titled "第31章 人工智能提示整理器" (Chapter 31: AI Prompt Organizer). It is designed to help users generate story prompts using AI. The form includes several sections with icons and input fields:

- 故事背景设定为:** (Story background setting:)
- 我的故事中的人物包括:** (Characters in my story include:)
- 我的特殊能力为:** (My special ability is:)
- 我凭借自身特殊特质能够做到的一件事是:** (One thing I can do with my special traits is:)
- 你的特殊性格特征在社会上对学生产生哪些影响? (比如: 让人喜欢、讨厌、觉得有趣、生气等)** (How does your special personality affect students in society? (e.g., making people like, dislike, find interesting, or angry))
- 什么体裁? (第一圈)** (What genre? (First circle))
  - A. 喜剧 (Comedy)
  - B. 冒险 (Adventure)
  - C. 科幻小说 (Science fiction)
  - D. 幻想症 (Fantasy)
- 何种基调? (第二圈)** (What tone? (Second circle))
  - A. 幽默的 (Humorous)
  - B. 神秘的 (Mysterious)
  - C. 温暖的 (Warm)
  - D. 阴郁的 (Gloomy)

or more. By using ChatGPT as an assistive technology the students were able to learn about and use the story elements to write a story that they can be proud of that was dynamic, personal, and unique.”

This lesson exemplifies designing for learning because the AI tool created an opportunity for creative expression, encouraging students to see the vast potential of their own ideas. The output of ChatGPT, in this case, expanded learning opportunities for students with diverse needs. The teacher ensured that the story centered student voice with the prompt organizer which scaffolds prompt generation. Notably, Mr. Jones controlled the information entered into ChatGPT to protect student privacy and comply with age restrictions of the platform. This was a team effort made possible by the teaching team including: Howard Fox (Teacher Aide), Jane Torrance (Vision Teacher), JD Wissner (Teacher Assistant), and Vicky Machado (ENL Teacher).

*Mr. Matthew Jones and Mr. Howard Fox (Teacher Aide) supporting students in filling out their prompt organizer.*



## Strategy 5: Promote Awareness and Agency

### Leaders, Teachers, Learners, Caregivers, and Community Members

Because AI literacy is a skill for everyone, schools and districts can support not only their students but also families and caregivers and their broader community to be **aware** of how AI tools are being used, and to understand the **agency** they have in deciding if and how they will use them to impact their lives and society. This includes increasing critical consciousness of how AI tools can perpetuate and exacerbate existing inequities in our society and raising awareness about algorithmic bias and advocating for changes in policies around algorithms and automation in our society.

We identify the following tactics for students, teachers, and caregivers to promote awareness and agency while using AI tools:

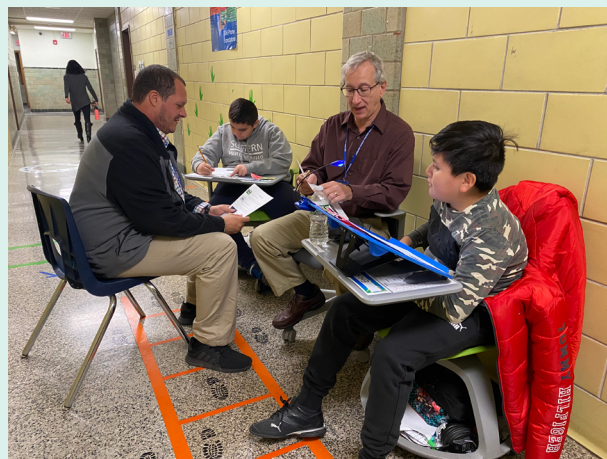
- **Learn.** Information is power, and awareness and agency of AI tools is enhanced with increasing knowledge about how AI works. Opportunities for students, teachers and caregivers to learn about AI and its applications in education should be provided in accessible modalities and languages.
- **Communicate.** School districts have a responsibility to be transparent with parents and caregivers about how AI technologies are being used in schools, including data privacy and ownership and decision making power of algorithms. Parents and caregivers should

或者更多。通过将ChatGPT作为辅助技术，学生们能够学习并运用故事元素，创作出一部充满活力、富有个人特色且独具匠心的作品，从而获得成就感。

本课充分体现了以学习为导向的设计理念，因为人工智能工具为学生提供了创意表达的机会，激发他们认识到自身蕴藏的巨大潜能。ChatGPT的输出结果在此案例中为不同需求的学生拓展了学习机会。教师确保故事以学生视角为核心展开叙述。

该提示生成器负责搭建提示词生成框架。值得注意的是，琼斯先生严格管控输入ChatGPT的信息内容，以保护学生隐私并符合平台年龄限制要求。这一团队协作成果得益于以下教学团队的支持：霍华德·福克斯（教师助理）、简·托兰斯（视觉教师）、JD·维斯纳（教师助手）以及维姬·马查多（英语语言教师）。

马修·琼斯先生与霍华德·福克斯先生（教师助理）协助学生填写提示性组织表。



## 策略5：提升意识与自主性

### 领导者、教师、学习者、照护者及社区成员

由于人工智能素养是全民必备技能，学校和教育机构不仅能帮助学生提升能力，还能引导家庭成员、照护者及更广泛社区认识人工智能工具的应用方式，并理解他们在决定是否使用这些工具及其具体应用时所拥有的**主动权**——这些工具将如何影响个人生活与社会进程。这包括增强对人工智能工具可能加剧社会不平等现象的批判性认知，提升对算法偏见的认知水平，并推动社会层面关于算法与自动化应用政策的改革。

我们为学生、教师及照护者制定了以下策略，旨在利用人工智能工具提升意识与自主性：

- **学习。**信息就是力量，随着对人工智能工作原理的了解不断加深，人工智能工具的意识 and 能动性也得到增强。应以可获取的方式和语言为学生、教师和护理人员提供学习人工智能及其在教育中应用的机会。
- **交流。**学区有责任向家长和监护人透明地说明人工智能技术在学校中的使用情况，包括数据隐私和所有权以及算法的决策权。家长和监护人应该

be afforded the opportunity to learn about these AI tools, and then prompted with an opportunity to opt in or out of such use.

- **Ask.** There are many unknowns with emerging technologies and most people likely do not know what questions to ask in order to promote safe and ethical application of AI tools. Schools and districts should develop resources to help students, teachers and caregivers understand what questions to ask and where to go for more information.
- **Advocate.** Emerging technologies are evolving with unknown risks. We all have a responsibility to understand what our rights are in regards to data privacy and ownership, as well as the decision making power of AI tools. We know that in some cases policy and guidance will be responsive to foul play and we should proactively create spaces to advocate for our own rights and protections in this evolving technological landscape.

## Students Teach Parents at Ballard High School MisinfoNight

[MisinfoDay](#) is an annual media literacy educational event hosted by the University of Washington Information School to teach high school students, teachers, and librarians to evaluate online information. It has since expanded its resource repository to support educators in running their own MisinfoDay event on their campus.

Successful community engagement occurred during MisinfoNight at Ballard High School in Seattle where teachers planned and hosted an event inviting parents, caregivers, and other adults in the community to learn from 300 9th-grade world history students on topics such as confirmation bias, influence of algorithms, AI-generated deep fake images, and methods to assess the reliability of information. The event was set up with interactive displays and stations presented by students.

*Students Presenting on Misinformation at Ballard High School in Seattle, WA.*



At the end of the night, students even asked family members and attendees to pull out their phones and practice their new learnings on sample online posts.

Learn more about:

- [MisinfoDay Resource Library](#)
- [NPR Article about MisinfoDay](#): AI images and conspiracy theories are driving a push for media literacy education
- [MisinfoNight at Ballard High School](#)

被给予了解这些人工智能工具的机会，随后被提示可选择是否使用此类工具。

- **询问。**新兴技术存在许多未知因素，大多数人可能不知道应该提出哪些问题，以促进人工智能工具的安全和伦理应用。学校和学区应开发资源，帮助学生、教师和照顾者了解应该提出哪些问题以及去哪里获取更多信息。
- **倡导者。**新兴技术发展过程中潜藏着未知风险。我们每个人都肩负着理解自身数据隐私权与所有权、以及人工智能工具决策权的责任。我们深知在某些情况下，政策与指导方针将针对不当行为作出调整，因此应当主动创造空间，在这个不断演进的技术环境中为自身权益与保护措施发声。

## 巴拉德高中教师开展家长反虚假信息教育晚会

[MisinfoDay](#)是华盛顿大学信息学院主办的年度媒介素养教育活动，旨在帮助高中生、教师和图书管理员学会甄别网络信息。该活动现已扩展资源库，为教育工作者在校内自主开展MisinfoDay活动提供支持。

西雅图巴拉德高中举办的‘MisinfoNight’活动中，教师们精心策划了一场社区互动盛宴。活动邀请家长、监护人及社区居民参与，与300名九年级世界历史学生共同探讨确认偏误、算法影响、AI生成的深度伪造图像以及信息可靠性评估等主题。现场不仅设有学生设计的互动展板和趣味互动站，更通过寓教于乐的方式让参与者切身感受科技与人文的碰撞。

华盛顿州西雅图市巴拉德高中学生关于错误信息的演讲。

当晚活动结束后，学生们甚至要求在场的家属和参与者拿出手机，通过示范性网络帖子来练习新学到的内容。



了解更多关于：

- [MisinfoDay资源库](#)
- [NPR关于MisinfoDay的文章](#):人工智能图像和阴谋论正在推动媒体素养教育
- [巴拉德高中Misinfo之夜](#)

# Conclusion

Our AI Literacy Framework seeks to inform educational leaders across contexts to make decisions about how to design learning opportunities to promote AI literacy. To better understand how to promote AI literacy, we build from foundational work across media literacy, data literacy, digital citizenship and computational thinking. We emphasize that understanding, evaluating, and using AI are coinciding Modes of Engagement that can support each other. Further, understanding and evaluating AI, while centering human judgment and justice, are critical to making informed decisions about if and how to use AI in different contexts.

We propose five strategies for leaders, educators, learners, and families to promote AI literacy for all. These strategies include providing guidance for adoption and evaluation, integrating AI literacy across grades and subject-area learning, facilitating professional learning, designing powerful learning experiences, and promoting awareness and agency.

AI literacy equips us with skill sets to promote individual agency and awareness in order to make informed decisions about how to leverage AI tools for individual and societal benefit. Looking ahead, we call for and seek to support the development of additional resources and guidance for educators, learners, and families to help them make informed decisions about if and when to integrate AI-enabled systems and tools in various contexts, as well as how to provide appropriate scaffoldings to learners when they do.

# 结论

我们的AI素养框架旨在为不同领域的教育领导者提供决策参考，帮助他们设计促进AI素养的学习方案。为深入理解AI素养的推广策略，我们基于媒介素养、数据素养、数字公民意识及计算思维等基础理论展开研究。我们强调，理解AI、评估AI应用与运用AI是相互促进的协同参与模式。此外，在不同应用场景中，基于人类判断与公平原则对AI进行理解评估，对于制定是否采用AI技术及其具体实施方案具有关键指导意义。

我们为领导者、教育工作者、学习者及家庭群体提出了五项策略，旨在提升全民人工智能素养。具体包括：提供技术应用与效果评估指导、将人工智能素养融入各年级及学科教学、促进专业能力发展、设计高效学习体验，以及增强公众认知与自主决策能力。

人工智能素养赋予我们提升个人自主性与认知能力的技能，使我们能够基于充分信息，明智决策如何运用AI工具造福个人与社会。展望未来，我们呼吁并致力于为教育工作者、学习者及家庭提供更多资源与指导，帮助他们在不同场景中判断是否以及何时引入AI系统与工具，并在实际应用时为学习者提供恰当的引导框架。

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