# A Framework for Powerful Learning with Emerging Technology

November 2025

Digital Promise®
Accelerating Innovation in Education

Emerging technologies hold immense promise to promote powerful learning. This framework and the accompanying paper provide a guide for developers, learners, and educators to create powerful learning experiences with emerging technology.

Our **Framework for Powerful Learning with Emerging Technology**, drawing from a comprehensive review of research and recommended practices including 59 expert interviews, articulates practical design recommendations to position emerging technologies as a resource that educators, caregivers, and learners can leverage to support learning experiences and develop lifelong skills. The work is based on the foundational understanding that emerging technologies complement human intelligence rather than replace it.

The framework is grounded in three principles for developing products that enable powerful learning:

## Learner-Centered:

Emerging technology tools can realize learner variability, helping all students reach their full potential, when they **promote agency**, **foster metacognition** and when developers **enable accessibility**. These technologies can enhance powerful learning experiences through relevance, purpose, productive struggle and reflection.


## Evidence-Based:

The starting point for developing emerging technology-enabled tools is to **apply research** and **use meaningful measures** of learning. Developers should **leverage relevant expertise** throughout these processes, such as researchers, subject matter experts, and educators, and learners through co-design.

## Skill-Building:

Emerging technology-enabled tools must focus both on academic content and building durable skills. Among those, tools should **support critical thinking, spark creativity**, and **cultivate collaboration**. Building, and not stunting, these durable skills demands thoughtful and intentional design guided by experts who understand the research and how to translate it to practice.

Table 1. Powerful Learning with Emerging Technologies Framework Overview

| Principle | Practice | Strategy |
|---|---|---|
| Evidence-Based | Apply Research | Leverage learning theories |
| | | Integrate research-based instructional practices |
| | Use Meaningful Measures | Define learning outcomes |
| | | Plan for iterative product improvements |
| | Leverage Relevant Expertise | Collaborate with experts throughout development |
| | | Co-design with educators and learners |
| Learner-Centered | Promote Agency | Personalize for learners |
| | | Make learning relevant |
| | | Ground in purpose |
| | | *Safety spotlight:* Privacy |
| | Foster Metacognition | Enable productive struggle |
| | | Provide reflective opportunities |
| | | *Safety spotlight:* Explainability |
| | Enable Accessibility | Include assistive technologies |
| | | Consider multimodality |
| | | Allow for translanguaging |
| | | *Safety spotlight:* Fairness |
| Skill-Building | Support Critical Thinking | Foster inquiry |
| | | Promote learner's understanding of emerging technologies |
| | | Encourage evaluation of emerging technologies |
| | Spark Creativity | Elevate the human creative process |
| | | Scaffold creativity |
| | Cultivate Collaboration | Create opportunities for human connection |
| | | Facilitate collaborative efforts |

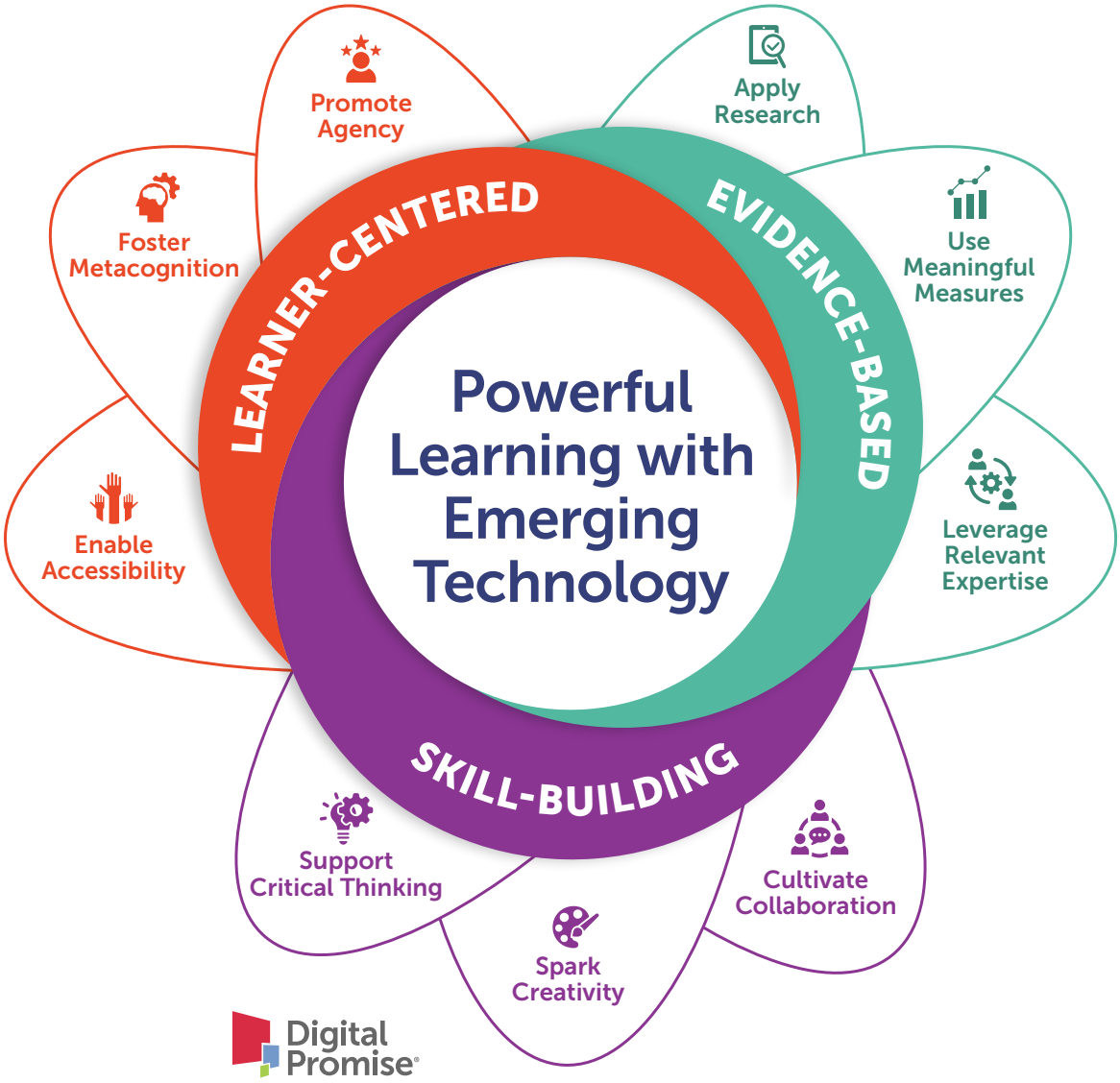
We advocate for product development teams to leverage the recommendations within this framework and accompanying paper throughout product design and development. Similarly, we advocate for education leaders, educators, and learners to leverage these principles to evaluate the tools they consider using for learning and to inform the design of learning environments that integrate emerging technologies. By embedding these principles throughout product design, selection, and implementation, we aim to create a foundation that makes learning powerful for each unique learner.

Continue reading for actionable steps to take and access to product spotlights exemplifying each principle.

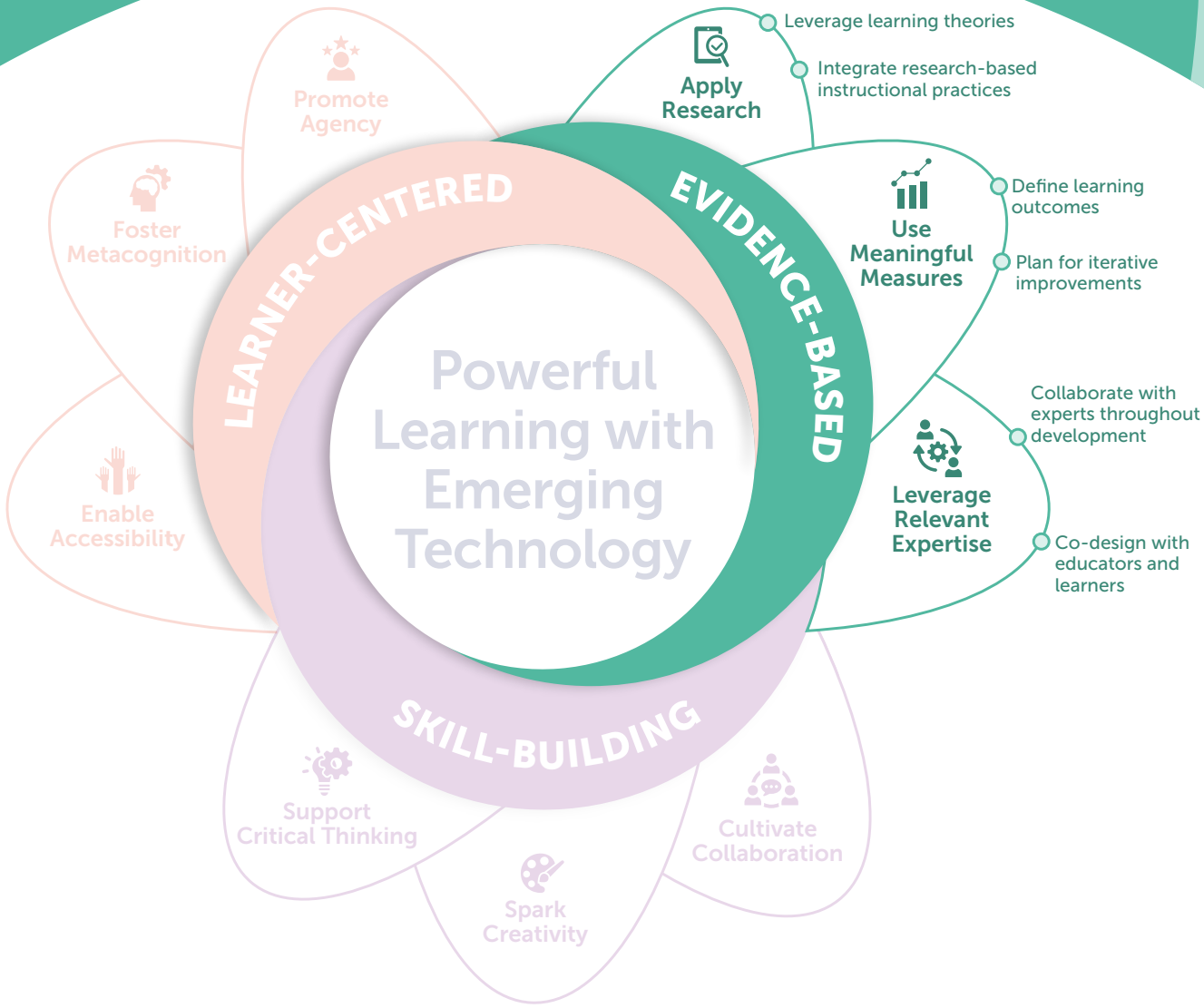
# Introduction

The Framework for Powerful Learning with Emerging Technologies provides developers with recommended actions to design and use edtech tools in ways that are evidence-based, learner-centered, and skill-building. These three principles provide guidance for emerging technologies to be integrated in ways that promote powerful learning, enhancing learner agency, curosity, purpose and connection. We recommend that developers consider the practices and strategies holistically across all three principles, rather than focusing on one principle, as the concepts are mutually reinforcing. Additionally, they should consider how edtech tools are implemented within systems of educators and learners, ensuring that the technology is not interfering with human relationships or interactions that promote learning. By applying the actions below, edtech products can more effectively and equitably serve learners.

For greater context and to explore the research behind these recommended actions, we encourage developers to read the accompanying paper.



# Principle: Evidence-Based




## PRODUCT SPOTLIGHTS

Check out how these emerging technology-enabled tools are designing to align to this principle.

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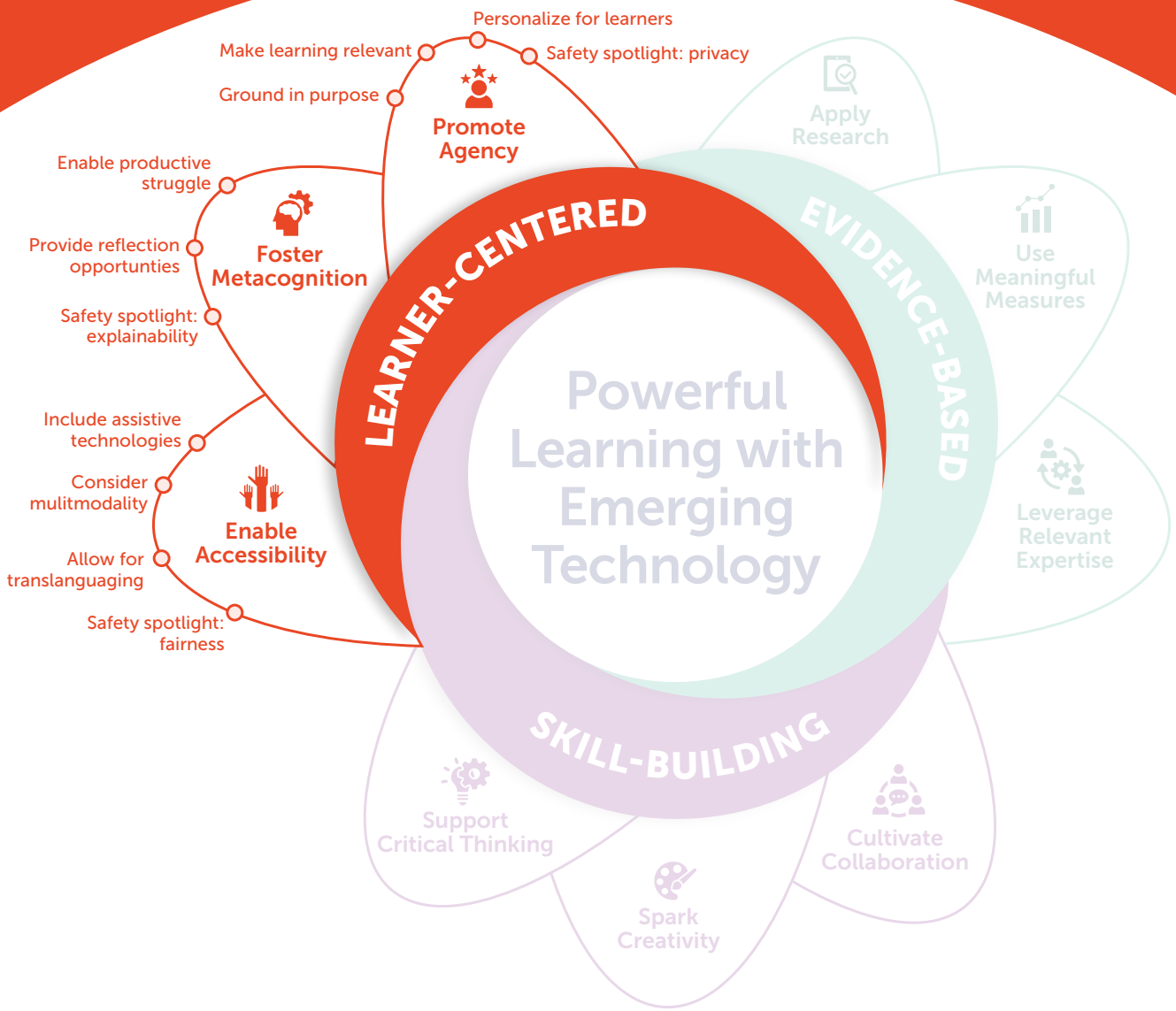
| Practice | Strategy | Actions |
|---|---|---|
|  **Apply Research** | **Leverage Learning Theories** | • Ground products in a learning theory, and understand the design and implementation implications of that learning theory.<br>• Develop a theory of change grounded in research about learning, with a clearly articulated description of the product's intended impact on learning. |
| | **Integrate Research-Based Instructional Practices** | • Leverage research-based frameworks and practices that target subject-area skill development to support product design decisions.<br>• Communicate the evidence base for products with current and potential users.<br>• Review and apply new education research relevant to the product. |
|  **Use Meaningful Measures** | **Define Learning Outcomes** | • Define learning outcomes that center the skills and knowledge of learners.<br>• Measure baseline metrics and learner growth using validated and reliable instruments to ensure outcomes are properly captured. |
| | **Plan for Iterative Product Improvements** | • Leverage multiple methods of measurement (within and outside the product) across periodic checkpoints to evaluate growth of learners' skills and knowledge and to assess learner outcomes and tool effectiveness.<br>• Review ESSA's Tiers of Evidence to determine how the product team can align with recommended research practices to evaluate and demonstrate impact, and create a research plan to meet the most meaningful level of rigor. |
|  **Leverage Relevant Expertise** | **Collaborate with Experts Throughout Development** | • Include subject matter experts (e.g. learning scientists, education researchers, and practitioners) in the design process from concept through development and launch.<br>• Collaborate with experts in specific disciplines to support subject area learning. |
| | **Co-Design with Educators and Learners** | • Engage educators, children, and families to co-design tools that support learners' social and emotional maturity, cognitive capacities, and learning needs.<br>• Include representative users from the product's target audience with diverse backgrounds, abilities, and contexts as active co-creators throughout design and development.<br>• Include users when making decisions about key product features to ensure tools authentically reflect their needs, goals, and intended use cases in real-world contexts. |

# Principle: Learner-Centered




## PRODUCT SPOTLIGHTS

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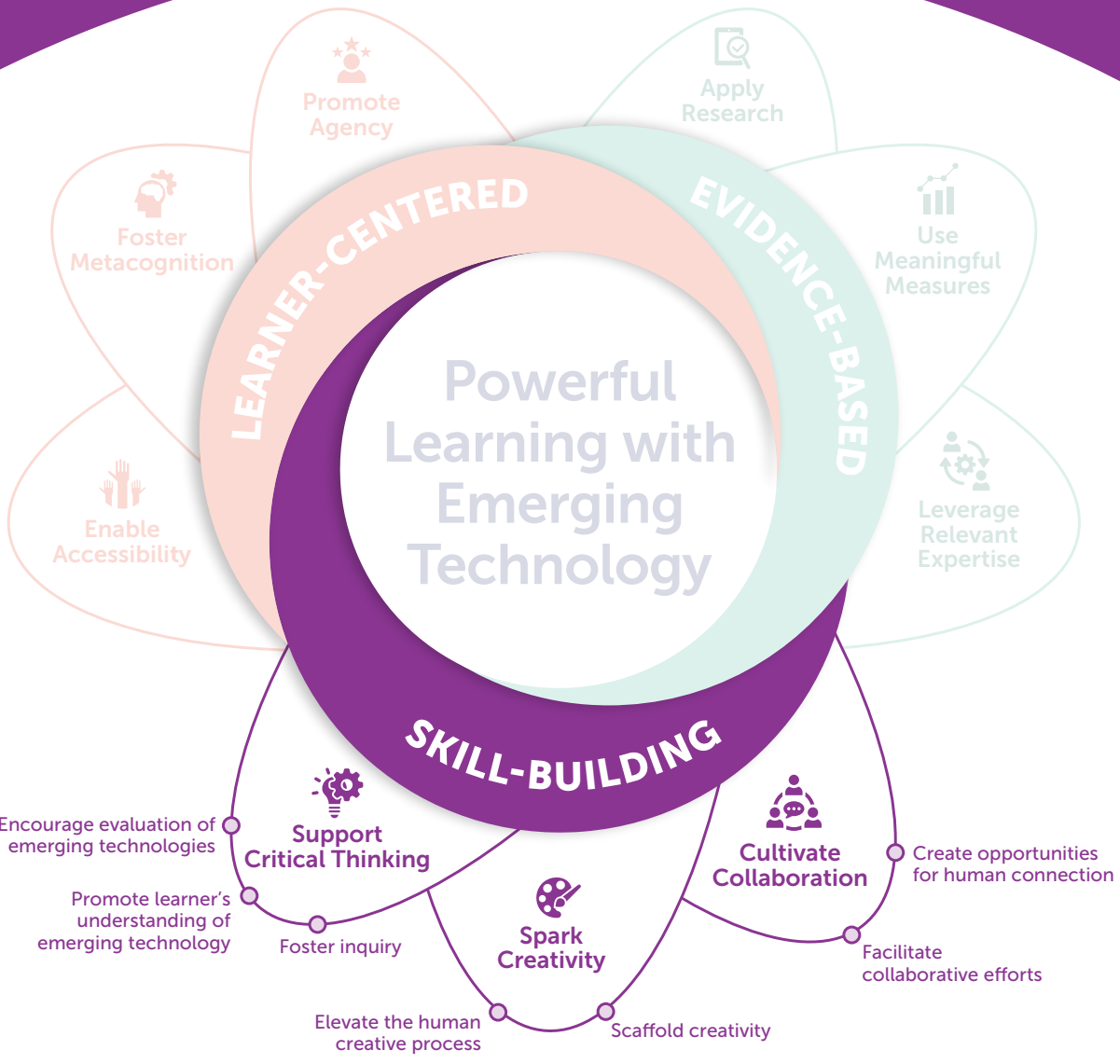
| Practice | Strategy | Actions |
|---|---|---|
| Promote Agency | Personalize for Learners | • Allow users to choose when and how they use adaptive AI features and supports to increase engagement, including allowing for opt-out.<br>• Provide customized, real-time formative and adaptive feedback as well as actionable, data-driven recommendations for learners, educators, or caregivers. |
| | Make Learning Relevant | • Incorporate and align content with learners' funds of knowledge (their lived experiences, personal cultures, and backgrounds).<br>• Leverage frameworks to apply funds of knowledge into the learning environment that connect learning to real-world experiences, including challenge-based learning, connected learning, and life-relevant learning. |
| | Ground in Purpose | • Help learners to understand how their effort on a task is meaningful and aligned to their values and long-term goals.<br>• Embed content learning in real-world scenarios that can have an impact on the learner's career pathway or local/global community. |
| | Safety Spotlight: Privacy | • Establish data privacy and security measures to protect data and guard against unauthorized access.<br>• Carefully consider what data is collected and how it's used, publishing privacy principles that adhere to and exceed applicable regulations. |
| Foster Metacognition | Enable Productive Struggle | • Encourage learners to bring their own thinking and ideas to the table before using generative AI, allowing them to engage more deeply in their own thinking and learning.<br>• Create a safe space for taking risks and making mistakes, and provide productive feedback to encourage learning from those mistakes, paired with opportunities to try multiple times.<br>• Ensure content is appropriately challenging while offering new strategies for learners to consider as they make adjustments to their learning process. |
| | Provide Reflection Opportunities | • Encourage learners to make their thinking visible, and provide opportunities for them to pause, reflect on, and adjust their thinking before continuing with their learning.<br>• Provide learner-facing data reporting to help learners make their own decisions about how to adjust their behaviors and goals and engage in self-regulated learning.<br>• Allow learners to customize the frequency, length, and content of feedback and reflective prompts. |

| Practice | Strategy | Actions |
|---|---|---|
| | **Safety Spotlight: Explainability** | • Ensure learners have scaffolds to understand how to interpret their data and apply feedback to meet their learning goals.<br>• When predictive analytics provide automatic suggestions, support learners to be aware of how their data was utilized to make predictions, and offer opportunities for them to confirm or adjust the suggested next steps to meet their learning goals.<br>• Provide opportunities for learners to customize how their data is summarized and shared to best suit their needs and learning goals. |
|  **Enable Accessibility** | **Include Assistive Technologies** | • Provide support to meet all learners' abilities and needs, such as closed captioning systems, translation services, American Sign Language (ASL), text-to-speech, adjustable text formats, text-to-audio and transcription support features, and, when relevant, wearable emerging technology-enabled devices.<br>• Conduct an accessibility audit using a VPAT (Voluntary Product Accessibility Template) to ensure adherence to accessibility guidelines like WCAG 2.1 (Web Content Accessibility Guidelines) and Section 508. |
| | **Consider Multimodality** | • Embed options that allow learners to receive information across different modalities, such as speech-to-text, and utilize multiple modes of responding, including drawing, speaking, or writing.<br>• Ensure that multiple representations do not add to cognitive load by keeping them clear and level-appropriate, and allow users to select which modality(s) they would like presented rather than presenting them all. |
| | **Allow for Translanguaging** | • Allow opportunities for learners to communicate across multiple languages.<br>• Support and integrate learners' home languages when incorporating cultural content into lessons to promote academic growth. |
| | **Safety Spotlight: Fairness** | • Ensure humans (e.g., learners, educators, caregivers) have opportunities to apply judgment in regard to the ethics and impact of data collection, reporting, and use.<br>• Implement ongoing and active processes to identify and mitigate risks within generated outputs to prevent exacerbating existing learning barriers. |

# Principle: Skill-Building




## PRODUCT SPOTLIGHTS

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TalkingPoints | OKO | Teaching Lab

| Practice | Strategy | Actions |
|---|---|---|
|  **Support Critical Thinking** | **Foster Inquiry** | • Encourage learners to ask questions in order to consider multiple perspectives and missing information.<br>• Scaffold background knowledge and promote content-area skillsets so that learners can more readily engage in critical thinking.<br>• Embed emerging technologies in inquiry-driven learning experiences to promote learners' curiosity and motivation to engage in critical thinking. |
| | **Promote Learner's Understanding of Emerging Technologies** | • Indicate where emerging technologies are leveraged within tools to generate outputs or recommendations.<br>• Provide developmentally appropriate explanations, platforms, and learning experiences to help learners understand how AI outputs and recommendations are generated. |
| | **Encourage Evaluation of Emerging Technologies** | • Provide opportunities to verify sources and cross-check information as well as opportunities for users to report errors or bias in generated outputs.<br>• Support learners to evaluate AI by encouraging reflection on the accuracy and potential bias of outputs or recommendations.<br>• Allow learners and educators to confirm, override, adapt, and modify outputs or recommendations as needed for the intended purpose and audience. |
|  **Spark Creativity** | **Elevate the Human Creative Process** | • Provide scaffolds and starting points to support learners in their own creative processes, rather than designing the tool to be creative on the learner's behalf.<br>• Integrate emerging technologies into learning experiences that promote curiosity, which can engage learners in sustained creative learning and problem-solving experiences. |
| | **Scaffold Creativity** | • Encourage learners' creativity by providing open-ended opportunities for learners to explore and apply new ideas. Discourage mental offloading to an AI system by balancing the depth and frequency of guidance with opportunities to apply their learning.<br>• Integrate AI-enhanced features into platforms and processes that learners are already leveraging for their creativity. |

| Practice | Strategy | Actions |
|---|---|---|
|  **Cultivate Collaboration** | **Create Opportunities for Human Connection** | • Develop AI that complements and supports rather than interferes with and replaces human relationships, scaffolding learners' connections to each other.<br>• Foster playful environments where learners can actively engage, experiment, and connect with other humans to make deeper learning connections, where possible. |
| | **Facilitate Collaborative Efforts** | • Incorporate features and opportunities for learners to collaborate and problem-solve in groups, with AI serving a supporting or tutoring role and providing clear expectations for effective collaboration.<br>• Facilitate reflection, guidance, and feedback with educators or trusted adults (where applicable) to maximize the benefits of collaboration.<br>• Provide opportunities to recognize learners for engaging in collaboration, building on each other's ideas or asking questions. |

## Read the full paper at DigitalPromise.org/EmergingTechFramework

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**Suggested Citation:**
Pattenhouse, M.*, Noakes, S.*, Mills, K., Shell, A., & Vollavanh, A. (2025, November). *Framework for Powerful Learning with Emerging Technology*. Digital Promise. https://doi.org/10.51388/20.500.12265/275

*Sierra Noakes and Megan Pattenhouse collaboratively served in the role of first author to develop this paper, with support from Kelly Mills, Ph.D., Alison Shell, Ph.D., and Andrew Vollavanh.



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Digital Promise

**Washington, D.C.:**
1001 Connecticut Ave. NW, Suite 935
Washington, D.C. 20036

**Redwood City, CA:**
702 Marshall St., Suite 340
Redwood City, CA 94063

**Website:** https://digitalpromise.org/