

WHICH SKILLS MATTER NOW?

A Data-Driven Framework
for K-12 in the Age of AI



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At a Glance

AI is reshaping which skills matter for professional success—and, therefore, what students need to learn. This report provides a data-driven framework for K-12 educators to navigate this shift, analyzing AI's impact on 1,000 workforce skills and mapping the implications for 140 high school learning objectives. It offers a clear method for identifying where and how curriculum needs to be rebalanced. Three key themes emerge:

- The cognitive bar is rising. Skills with high automation exposure now demand deeper conceptual understanding, not less, to empower students to direct and evaluate AI tools.
- The real divide is within subjects, not between them. No discipline loses relevance, but every discipline contains skills that require new instructional approaches alongside skills that remain foundational.
- Traditional assessment faces new challenges. When AI can generate polished outputs, evaluation must focus on the students' thinking, reasoning, and judgment.

The report introduces a four-quadrant framework—Deepen, Transform, Streamline, Anchor—that helps educators make evidence-based decisions about what to emphasize, what to redesign, and what to protect in their curriculum.

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Executive Summary

For decades, American K-12 education has operated under a stable assumption: that equipping students with a core body of content and procedural skills would prepare them for the future.

AI disrupts that assumption. When machines can write, compute, and generate sophisticated content, the natural fear is that the skills we've taught for generations will soon become obsolete.

But educators cannot build a strategy from fear—neither by abandoning the fundamentals nor defensively doubling down on them. They need a clear map of the new terrain: what's actually changing, how deeply, and what to do about it.

This report provides that map. Skills are the unit of analysis that connects what students learn to economic reality. We built a systematic bridge between AI's impact on 1,000 top labor market skills and 140 high school learning objectives, modeling how the interplay of automation and augmentation reshapes each one. The result is a framework that maps out what is shifting, what is stable, and where schools must adapt. This is not about identifying which skills matter less in an AI world. It is about understanding which essential skills now demand different instructional approaches because AI has changed how they are exercised.

How Skills Are Shifting: Core Themes

1. The Cognitive Bar Is Rising, Not Falling

When AI handles execution, students can no longer succeed by merely memorizing procedures. They must understand principles deeply enough to direct AI, evaluate its output, and recognize when it is wrong. A student who simply copies AI-generated solutions never builds the conceptual architecture needed to work effectively with AI as a tool.

This creates a central paradox: the very skills whose execution AI affects are becoming more essential to master than ever.

Consider writing. AI can now produce clear, organized prose on command. But this only elevates the importance of the human mind behind the output. The true work of writing is the work of thinking—discovering an idea, testing it against evidence, wrestling with ambiguity, and structuring a unique argument. A student who merely outsources drafting to a large language model (LLM) never builds this cognitive architecture. The same logic applies across disciplines. In mathematics, computational thinking and abstract reasoning matter more than ever, while procedural calculation is streamlined. In computer science, logic and system design are the foundation; specific syntax becomes less critical. The execution can be outsourced. The judgment cannot.



This means the skills with highest automation exposure are also the skills that now demand deeper conceptual understanding. Students must grasp the principles so thoroughly that they can direct AI, evaluate its output, and possess the critical judgment to know when to override it. The bar for mastery is rising.

At the same time, the most valuable human-centric skills—leadership, critical thinking, planning, complex problem-solving—now require greater sophistication. As AI handles routine tasks, human work becomes more focused on orchestrating complex systems, making strategic decisions, and applying judgment in novel situations. These capabilities must be scaffolded across K-12.

2. The Divide Runs Within Subjects, Not Between Them

Our analysis finds that every subject retains its relevance in the age of AI. The disruption is more granular. Every field—from STEM to the humanities—contains a mix of learning objectives that are stable and others that must be taught differently. In mathematics, procedural computation is highly automatable, yet problem formulation and navigating ambiguity remain deeply human. In English, AI effortlessly corrects grammar and spelling, while rhetorical judgment and persuasive communication resist automation. In science, data visualization can be streamlined, but experimental design and interpreting inconclusive evidence cannot.

This granularity is an opportunity. It means schools can make surgical, evidence-based adjustments rather than attempting wholesale curricular overhauls. The question is no longer “Which subjects matter?” but rather “Which components of each learning objective need a rebalancing of instructional time and focus?”

3. Traditional Ways of Measuring Learning Struggle to Capture What Matters Most

As AI automates execution, the final product—the essay, the code, the solution—becomes an unreliable signal of student learning. A polished essay may reflect sophisticated prompting, not deep understanding. A correct mathematical solution may mask a complete lack of student reasoning. Assessment must therefore pivot from evaluating the product to evaluating the process and judgment behind it. For skills transformed by AI, evaluation must capture the student’s workflow: What problem did they frame? Why did they choose a particular approach? How did they critique the LLM’s suggestions? How did they verify the output? The shift is from assessing what students produce to assessing how they think. Without this, schools risk graduating students who are adept at using AI tools but lack the underlying understanding to do so wisely and effectively.

The Framework: From Insights to Practice

Understanding these patterns is essential, but acting on them is the challenge. Schools need a decision-making system to translates insights about AI's impact into concrete instructional moves. Crucially, this system must respect that instructional time is education's scarcest resource. AI does not create more of it.

This report's framework is designed for rebalancing how that time is allocated. The core learning objectives that anchor K-12 education remain vital. What changes is the emphasis within those objectives: which intermediating skills require deeper investment, which can be practiced more efficiently in context, and which demand a shift in focus toward teaching judgment instead of mere execution.

To guide this rebalancing, we developed a four-quadrant framework that maps core skills based on two dimensions: **automation potential** (Can AI do this independently?) and **augmentation potential** (Can AI enhance human performance?). This produces four skill types, each reflecting a different approach to rebalancing instructional priorities:

- **Deepen (Low Automation/High Augmentation):** These skills resist automation but are amplified by AI. Students need deeper conceptual understanding so they can direct AI effectively and evaluate whether its suggestions are sound or misleading. What shifts: more time building conceptual foundations; less time on surface-level application.
- **Transform (High Automation/High Augmentation):** AI is both an executor and a collaborator. The teaching focus shifts from training solo execution to developing students as directors and editors of AI-human workflows. The goal is to cultivate judgment, quality control, and strategic thinking.
- **Streamline (High Automation/Low Augmentation):** AI performs these procedural skills independently and reliably. However, students still need to understand the underlying principles and structures since these remain prerequisites for higher-order work. The rebalancing here is subtle but significant. The foundational knowledge continues to be taught, but with less time spent on rote drills and more on applying these skills in authentic contexts. The instructional time reclaimed from practicing execution is reallocated to more cognitively demanding work in the framework's Deepen and Transform quadrants.
- **Anchor (Low Automation/Low Augmentation):** These are irreducibly human skills like leadership, ethical judgment, and collaboration. Because these skills develop through doing and experiencing consequences—not simply through instruction—they require protected time and genuine agency, shielded from efficiency pressures.

These four categories work in concert within individual learning objectives. In the sections that follow, we show how the framework applied to each subject area, identifying which intermediating skills warrant rebalancing.

Strategic Snapshot: The Epicenters of AI Disruption

Our analysis of 140 learning objectives reveals a clear pattern of AI's impact on the curriculum, pointing toward two dominant arenas of change and four keystone skills that demand immediate strategic focus.

The Big Picture: Two Quadrants Dominate

Nearly two-thirds of all skills fall into just two categories, defining the central challenge for educators:

- **64% of the curriculum** is driven by **Transform** (workflows to redesign with AI) and **Anchor** (human skills to reinforce). Focusing here will yield the greatest strategic return.

The Keystone Four: The Heart of the Curriculum

Four high-frequency skills form the core of interdisciplinary learning. How we approach them is critical.

1. **Critical Reading (Anchor):** The essential human skill of making meaning. Must be protected and deepened.
2. **Intercultural Competence (Deepen):** A human-centric skill supercharged by AI tools. A prime area for augmentation.
3. **Systems Thinking (Transform):** A workflow now shared with AI. The focus must shift from modeling mechanics to human judgment.
4. **Information Literacy (Streamline):** A skill whose mechanics are now automated. Instruction must pivot to higher-order evaluation and source credibility.

A Note on What This Report Does—and Doesn't—Do

The analysis in this report is designed to:

- Provide data-driven analysis of which skills will matter most in an AI-shaped economy
- Identify where and how curriculum emphasis should shift accordingly
- Offer a framework for translating this analysis into instructional and assessment decisions
- Highlight critical questions that educators and policymakers must grapple with

It is also important to flag what this report is not designed to do:

- Offer a single curriculum blueprint (schools and communities are too different)
- Prescribe specific lesson plans or activities (that is the domain of educators—examples in this report are strictly hypotheticals)
- Claim certainty about a future that remains in motion (AI capabilities are evolving rapidly)
- Minimize the importance of resources, access, and community context (these shape implementation profoundly)

The framework provides the diagnostic lens; educators and communities must determine how to apply it within their specific contexts. This division of labor is intentional: the skills analysis requires workforce data and systematic methodology, but instructional design requires local knowledge, student relationships, and pedagogical expertise that no external report can replicate.



INTRODUCTION:

A Challenge Without a Playbook

Walk into almost any American school today and you'll find educators caught between two impossible demands: prepare students for a future being reshaped by AI, and do it without clear guidance on what that future requires. Generative AI went mainstream barely three years ago, leaving educators to make high-stakes decisions about curriculum, instruction, and assessment while the ground shifts beneath them. Some schools default to preservation; others lurch toward wholesale AI adoption without clear purpose. Both approaches risk failing students. To understand why this moment is so distinct, it helps to examine how education has responded to major shifts in the past.

American education has periodically reoriented itself in response to economic and technological shifts. Industrialization necessitated first universal public education and then the advent of the comprehensive high school. Later, in the Space Age, Sputnik revealed a gap between what schools taught and what the economy required. Education responded with unusual clarity: calculus and trigonometry became central to math instruction; physics gained prominence in science. The target was clear, the scope was bounded, and the timeline was forgiving enough that curriculum committees could deliberate and implement. (Notably, despite predictions of educational transformation, the Internet age left curriculum and instruction largely unchanged.)

But unlike the targeted, bounded challenge of the Space Age, the rise of AI presents a problem so broad it renders the old playbook obsolete. It is not a matter of adding calculus or physics; it is a systemic shift that touches every domain, rippling across the entire curriculum and reshaping how instruction itself must work.

This systemic challenge is not only broad, but also fast. AI capabilities advance so rapidly that the skills that matter today may recede in importance tomorrow. A fixed curriculum blueprint, the traditional tool of educational reform, will be outdated as it's being implemented. In this rapidly changing landscape, schools need an agile decision-making framework, not a static answer.

It is also far less legible than past disruptions. Sputnik was a singular, public shock—a national challenge impossible to ignore, a visible symbol that made the mission clear. AI's impact is quieter and more fragmented, unfolding unevenly in the granular details of opaque workflows, subtly absorbing some tasks while amplifying the value of others. There is no single, explosive moment to force action, which makes institutional inertia insidiously tempting. Without a single crisis to galvanize a response, the path of least resistance is to wait—a delay that becomes more perilous as the ground continues to shift unseen.

This is not a distant threat; the transformation is already underway. AI can write code, draft legal briefs, generate research summaries, and create visual designs—tasks that were once the domain of trained

professionals. As AI automates routine execution, the human abilities that resist automation—navigating ambiguity, leading teams through uncertainty, making ethical judgments, evaluating complex evidence—become paramount. A writer who cannot think critically cannot judge whether AI-generated prose is sound. A mathematician who has only memorized procedures cannot spot when an AI solution is technically correct but logically flawed. Foundational knowledge is no longer just for human execution; it is the prerequisite for critically directing and evaluating the work of intelligent machines.

The result is a generational challenge that will determine whether today's kindergarteners graduate prepared—or spend their careers trying to catch up.

A Framework for Confronting This Challenge

Most conversations about AI in education start and end with the same question: “How do we use AI in the classroom?” The answers proliferate—AI tutors, automated grading, generative drafting tools, personalized practice.

This report reframes that question. Rather than asking how to use AI as a classroom tool, it asks: “What should students learn differently because AI exists?”

This is not just a question about pedagogy or technology adoption. It's a question about which knowledge sets and skills remain essential, which change in character, and which can be thoughtfully restructured. That distinction matters enormously. One school, mistaking the new tool for a new vision, can deploy sophisticated AI tutors only to reinforce yesterday's curriculum for tomorrow's workforce. Another, armed with clarity about which skills matter most and how AI reshapes them, can prepare students far more effectively. The tool is not the answer; the thinking is.

By grounding our analysis in concrete data about which skills matter most in an AI-shaped economy, this report provides the guidance educators need to act. We do not prescribe a single blueprint, because schools and communities differ. Instead, we offer clarity on the “what” and the “why,” empowering local leaders and educators to determine the “how.” It is the first systematic bridge between workforce transformation and classroom redesign, arriving at a time when educators need it most.

Rebalancing, Not Replacement

Before diving into our methodology and analysis, one principle must be clear: this report does not ask educators to do more. It asks them to do things differently.



Instructional time is education's scarcest resource. Rather than adding AI-related content to an already overloaded curriculum, schools need a systematic approach to rebalancing: shifting emphasis within existing learning objectives based on which intermediating skills matter most in this new context.

The learning objectives that anchor secondary education—writing, mathematical reasoning, scientific inquiry, historical analysis, computational thinking—remain essential. A student still needs to write clearly, reason quantitatively, and evaluate evidence rigorously. But the intermediating skills that comprise these objectives are not equally valuable in every context. Some skills—like directing AI, evaluating outputs, and navigating ambiguity—deserve greater emphasis. Others—like manual execution of procedures AI handles reliably—can be practiced more efficiently within applied contexts rather than in isolation.

This is not about abandoning fundamentals, but recognizing that their purpose is evolving. The goal is to ensure that foundational skills serve higher-order work, and the relationship between those skills and their application is shifting. Some skills need deeper conceptual grounding so students can direct AI effectively. Others require learning entirely new workflows where students act as judges and strategists, not just solo executors. Some skills remain foundational but shift from standalone instruction to just-in-time practice embedded in applied contexts. Meanwhile, some skills should be protected from efficiency pressure entirely because they develop only through direct human experience.

The common thread is reallocation. The framework that follows provides the evidence base for deciding where instructional time can be most powerfully spent.

Structure of This Report

- Section I lays out our methodology: how we mapped learning objectives to intermediating skills, modeled AI impacts, and arrived at our findings.
- Section II explores the concepts of AI automation and augmentation and their impact on core skills.
- Section III offers a framework for translating these findings into instructional decisions.
- Section IV operationalizes this framework by applying it to the classroom context.
- Section V outlines implications for policy, resource allocation, and educator support—and situates this work within larger questions about what education is for in an age of AI.

How This Analysis Relates to aiEDU's AI Readiness Framework

This research provides the empirical foundation for aiEDU's AI Readiness Framework. Where this report identifies which skills are shifting and why, the AI Readiness Framework translates those insights into actionable competencies for students and educators. Together, they form a coherent system: labor market analysis informing curricular priorities, which informs classroom practice.

SECTION I:

From Workforce to Classroom — A Methodology to Bridge the Gap

As AI accelerates changes across the labor market, educators face a pressing challenge: how to prepare students for a future that will look dramatically different from today. Addressing this requires understanding which skills matter most, how they are currently taught, and how their application is likely to evolve in an economy permeated by AI.

Two factors have stood in the way. First, most models for forecasting how AI will reshape work have been overly simplistic, structured around binary predictions of job destruction versus creation or automation vs. augmentation. As such, these models often miss the effects evidenced by past technological revolutions, from electricity to the internet: the biggest impacts are likely to be not in whether we work but in how we work. Second, and perhaps even more fundamentally, they lack a means for mapping workforce skills onto classroom curricula. Employers speak a language of skills while educators speak in terms of learning objectives. The gulf between them can be surprisingly wide, impeding educators from tracking changes in the skills students require for career success.

This study applies innovative methods for addressing both these gaps. This section outlines the methodologies used to connect high school learning objectives to workforce demands and to model the potential impacts of generative AI on those skills.

Our Data and Approach

Step 1: Catalog workforce skills and their AI exposure.

Our analysis began with a dataset of tens of millions of recent US job postings, each having required skills identified and standardized by Lightcast into their skills taxonomy. From these postings, we identified the 1,000 most frequently requested skills and then assessed AI impact across two dimensions:

- Automation exposure — the extent to which AI can perform the skill independently, reducing the need for human execution
- Augmentation exposure — the extent to which AI can support or enhance human performance of the skill, making it more efficient or effective



Skills were evaluated using a large language model using pairwise comparison to judge which skill in a given pair would be most likely to be automated. These pairwise comparisons were then aggregated to generate an automation score for each skill. This same process was repeated for skill augmentation. The resulting scores allowed each skill to be plotted on a two-dimensional matrix according to its automation and augmentation score.

This produces a clear lens into AI workforce impacts: skills like “SQL querying” and “taking meeting minutes” are highly automated by AI—the system can execute them with minimal human oversight. By contrast, capabilities such as “project management” and “go-to-market strategy” are highly augmented—AI elevates the speed, scope, and quality of what workers can do, but people still set the priorities.

Importantly, this approach evaluates automation and augmentation effects separately. As such, instead of forcing a binary determination, this method enables a more nuanced view, recognizing that both effects often play out simultaneously. “Writing” experiences high levels of both automation and augmentation through AI, with LLM’s making writers both more efficient and more effective at the same time.

Step 2: Parse state learning standards and identify core learning objectives.

While these signals are useful for employers, educators need a clearer bridge. We parsed state-level learning standards from 21 representative US states, extracting from these documents what students are expected to learn across core subjects like mathematics, science, English language arts, social studies, computer science, and world languages. This process distilled 140 learning objectives—the most critical competencies students are expected to develop—that are taught in grades 9–12. These learning objectives range from “critically respond to texts through deep reading, inference, prediction, and connection” (ELA) to “understand and apply geometric concepts, properties, theorems, and measurement to solve problems” (Mathematics). (See Appendix for the full list.)

Step 3: Identify the intermediating skills that bridge learning objectives and workforce skills.

To translate workforce-level skill impact scores to the aggregate learning objectives identified through Step 2, we used a novel approach, constructing an intermediating layer—the foundational abilities students develop in school that later combine to form workforce competencies. These are the connective tissue between learning and work: skills like “source credibility assessment,” “probabilistic reasoning,” and “written argumentation” that appear in both educational standards and job requirements, though often under different names.

Using large language models, we generated an initial set of intermediating skills derived from the learning objectives and workforce skills, then refined them through expert review. The result: 49

distinct intermediating skills spanning literacy, numeracy, reasoning, communication, creativity, and metacognition. (See Appendix for the full list.)

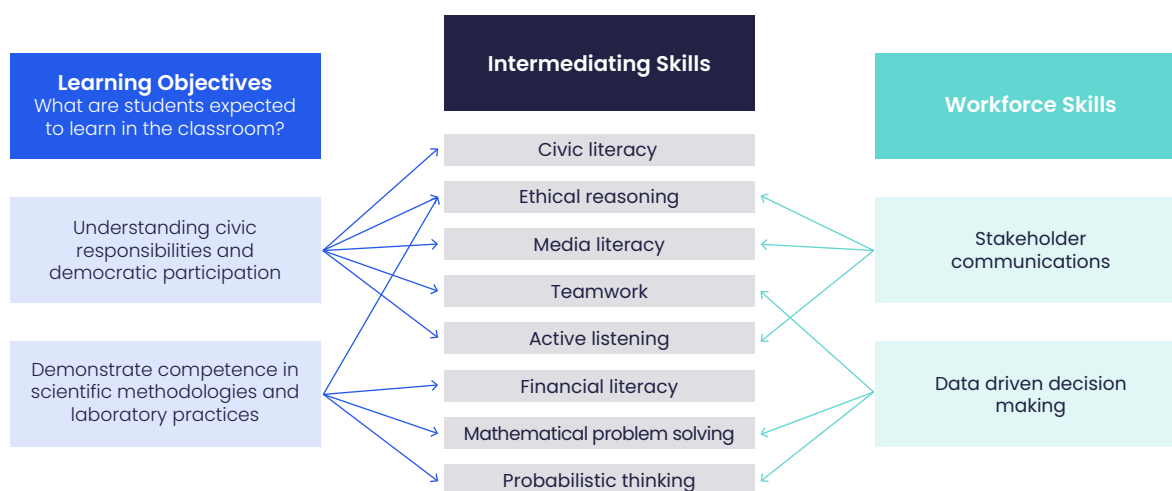
The critical insight is the many-to-many architecture: each learning objective draws on multiple intermediating skills, and each intermediating skill feeds into multiple workforce skills. For example, “source credibility assessment” is an intermediating skill that appears in research-focused learning objectives across history, science, and ELA. It later becomes part of workforce skills like “market research,” “legal analysis,” and “policy evaluation.” Similarly, “probabilistic thinking” appears in mathematics, science, and social studies learning objectives, but contributes to workforce skills ranging from “risk assessment” to “data-driven decision making.”

This architecture enabled the regression analysis that follows. By evaluating which intermediating skills were more likely to appear in highly automated or highly augmented workforce skills, we can infer the impact of AI on these skills.

The logic: if we know that the workforce skill “market research” faces 97th percentile automation exposure, and we know that “market research” depends on intermediating skills like data visualization, source credibility assessment, statistical reasoning, and evidence evaluation, we can evaluate how these intermediating skills show up in other workforce skills – including which are most prevalent in less automated skills – to infer the contribution of each intermediating skill on the automation exposure of “market research.”

We then repeat this process for augmentation exposure for each skill. By running this analysis across all 1,000 workforce skills and their underlying intermediating skill components, we generated automation and augmentation scores for each of the 49 intermediating skills. These scores tell us which foundational abilities AI automates and which it augments.

Figure 1. Mapping Learning Objectives to Workforce Skills via Intermediating Skills



The above graphic represents a selected sample of 140 learning objectives, 1000 workforce skills, and 50 intermediating skills

Step 4: Ladder up to learning objectives.

Finally, we mapped each of the 140 learning objectives to its component intermediating skills. This produces a granular picture: “Conduct and present research” (a learning objective) is comprised of seven intermediating skills—research design and planning, data collection methods, source credibility assessment, evidence evaluation, written communication, information literacy, and presentation design and delivery. The analysis reveals that research design and planning face both high automation (the 70th percentile of automation exposure across all skills) and high augmentation (the 88th percentile of augmentation likelihood), implying that AI can help students plan research, but they will still need to oversee the algorithms and drive the process. By contrast, source credibility assessment, where human judgment is most essential, faces lower automation (48th percentile) and only moderate augmentation (53rd percentile). The implication: spend less time on research procedure and more on teaching students to evaluate sources.

The analysis ultimately produces automation and augmentation scores for each intermediating skill (as well as for the learning objectives those skills comprise, though these are not central to the framework). But scores alone shouldn’t drive curriculum decisions. To help educators translate these scores into specific instructional decisions, we introduce a diagnostic framework that groups skills as follows: Anchor the irreducibly human, Streamline by folding procedural skills into higher-order work, Deepen through AI collaboration, or Transform the workflow entirely.

Limitations and Caveats

A few important notes on what this analysis does and doesn’t claim:

- On automation/augmentation scores: These scores reflect AI capabilities as of mid-2025. As models improve, these scores will shift. This analysis is a snapshot, not a prophecy.
- On intermediating skills: The 49 intermediating skills are a derived set, generated with LLM assistance and refined through expert review. They’re not an exhaustive taxonomy; other skills matter too. But they represent the core competencies most directly shaped by AI’s advancement.
- On equality and access: This analysis focuses on skill development and does not examine variations in access, resource availability, or broader structural factors that influence which students encounter particular learning objectives. Application of these findings should therefore be undertaken with careful consideration of contextual and institutional conditions.
- On rapid change: AI capabilities are evolving. The skill demands identified here are robust for the next 3–5 years, but schools should plan for periodic re-analysis and recalibration.

This framework is not prescriptive. It represents a logical system for translating data into decisions. How it is operationalized—what specific skills are emphasized, how instruction is redesigned, what routines and practices are implemented—will ultimately depend on each school’s context, student needs, and educator expertise.

SECTION II:

The Four Quadrants — Laying the Framework's Foundation

The Obvious Question—and the Better Question to Ask

Watch AI produce a clearly argued, vividly written five-paragraph essay, and the obvious first instinct is: Do we still need to teach essay-writing? The answer is almost always yes.

But the real question isn't whether we should teach it. It's how. If AI can execute a skill, the instructional challenge transforms in specific ways. We may need to deepen conceptual understanding so students can direct and evaluate AI output, not just accept it. We may need to teach students to harness AI as a thinking partner that amplifies their creativity rather than replaces it. We may need to shift time from procedural drills to ensuring students can supervise AI's execution for accuracy and ethical integrity. Or we may need to teach more students the skill at a foundational level, because AI makes complex tasks accessible to people who previously lacked the technical training—in the same way the value of numeracy rose once spreadsheet software enabled broader applications for calculation and modeling.

Understanding which shift applies to which skill—and translating that understanding into concrete instructional moves—is what the framework that follows provides.

Two Dimensions of AI's Impact

To answer that question, we need to distinguish between two different things AI can do—and resist the temptation to conflate them.

Automation is when AI performs a task for you, operating independently with minimal human involvement. When a lawyer uses AI to review thousands of contracts for standard clause violations, the AI is automating work that once required teams of associates and paralegals. The human sets parameters and reviews flagged items, but the execution is the machine's.

Augmentation is when AI helps you perform a task, enhancing your speed, capability, or level of operation. When an architect uses AI to generate and iterate design concepts more rapidly, she's still the designer; AI expands what she can explore in a set time. The work remains hers. AI amplifies her capacity.

The conventional assumption is that these are opposing forces—that jobs sort neatly into those that will be automated and those that will be augmented. Policy discussions, workforce training



programs, and career advice often reflect this binary: identify the at-risk jobs and steer people toward the safe ones.

But recent empirical evidence suggests this frame is off base. Research from the Burning Glass Institute, tracking millions of job postings before and after the emergence of large language models, finds a strong positive correlation between automation exposure and augmentation exposure across occupations. The jobs most exposed to one are overwhelmingly the jobs most exposed to the other. AI isn't sorting the labor market into winners and losers. It's transforming job content across a broad swath of the economy, automating some tasks while elevating others, often within the very same roles.

Consider project managers. Demand for skills like designing presentations and using spreadsheet software—functions that AI tools now handle efficiently—has softened. But demand for budgeting, scheduling, and strategic coordination has strengthened. The project manager whose routine tasks are being automated is the same project manager whose higher-order responsibilities are expanding. The role isn't disappearing; it's shifting.

The same pattern appears among financial analysts, who now spend far less time building models from scratch, while increasing the time spent on interpreting and pressure-testing AI-generated outputs. And among sales representatives, AI absorbs operational tasks while amplifying demand for relationship management and prospecting skills. In each case, the job persists—but its substance transforms.

The implication reframes the question entirely. The relevant unit of analysis is not the job, but the task. And the relevant question is not “which jobs will survive?” but “how will this job change, and what will people need to know to perform it well?”

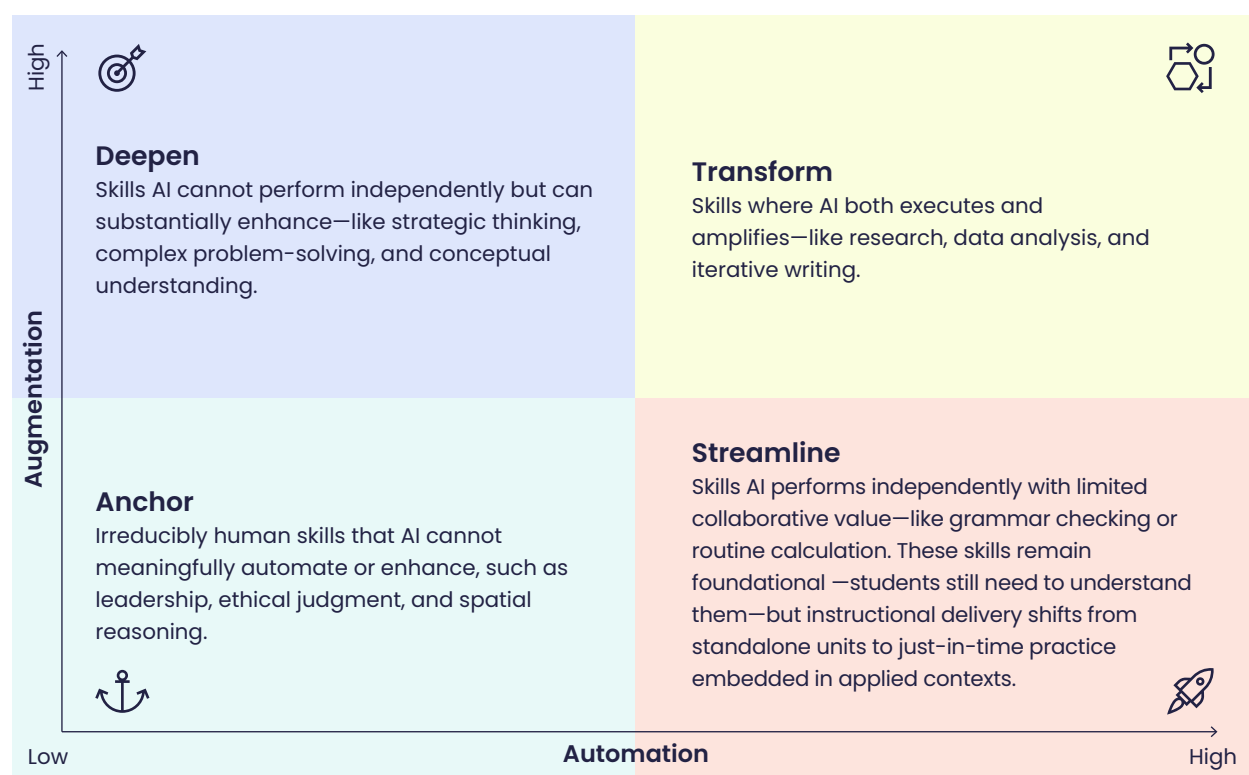
From Workforce to Classroom

These patterns are visible across the labor market. But educators don't teach “project management” or “financial analysis.” They teach reading, writing, mathematical reasoning, scientific inquiry, historical analysis. The question is how automation and augmentation reshape the need for and application of the foundational skills that underlie both academic success and workforce readiness.

To bridge this gap, we identified 49 intermediating skills—foundational competencies like “source credibility assessment,” “probabilistic reasoning,” and “written argumentation”—that connect what students learn in school to what workers do in the economy. (Section I details this methodology.) We then scored each intermediating skill on automation and augmentation exposure, based on how these skills appear across 1,000 workforce competencies and 140 K-12 learning objectives.

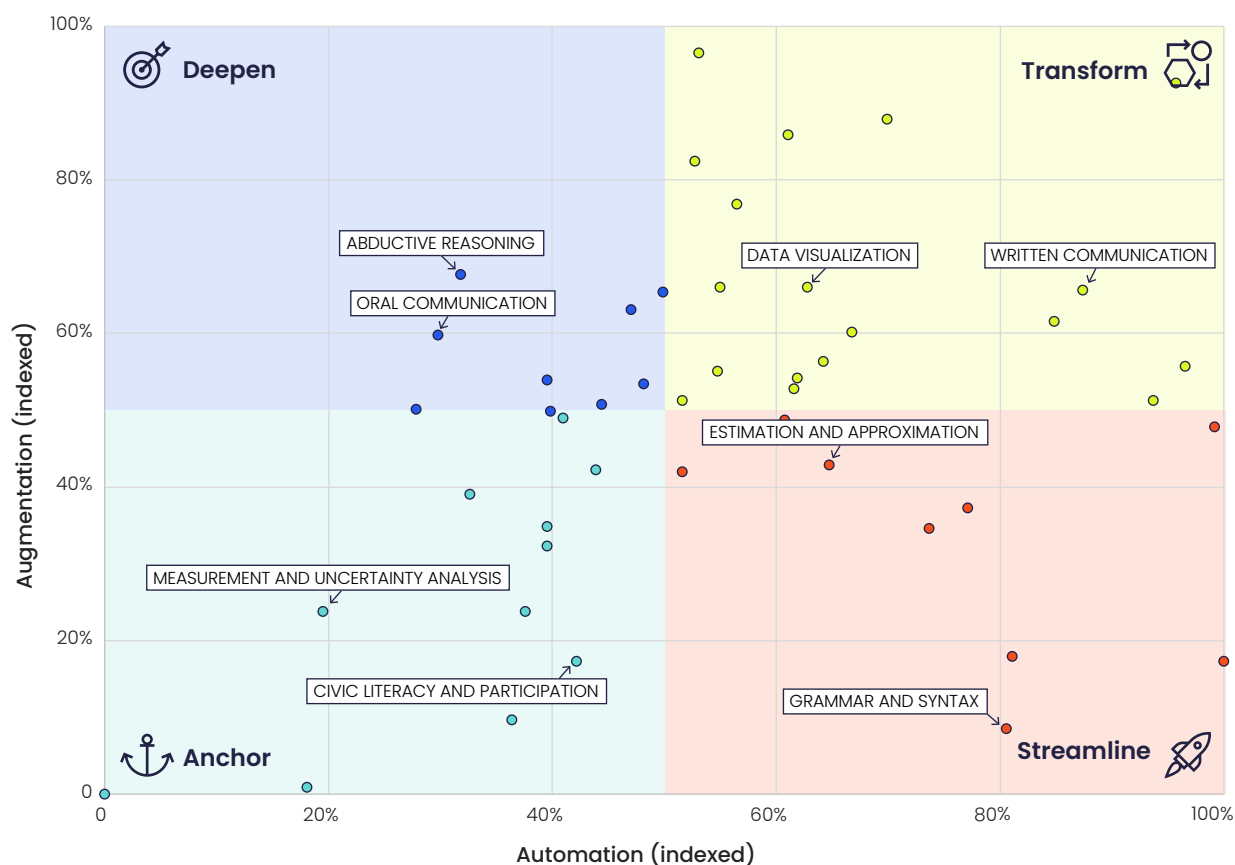
When we plot these 49 skills in a two-by-two matrix, four distinct patterns emerge:

Figure 2. The Four Quadrants of AI Automation and Augmentation



Each quadrant represents a different relationship between human and machine—and therefore a different instructional implication. A skill in the “Deepen” quadrant requires deeper conceptual teaching so students can direct AI effectively. A skill in the “Transform” quadrant requires rethinking the entire assignment structure and workflow. A skill in the “Streamline” quadrant shifts from being an end in itself to being a foundation for the development and exercise of other, more applied skills. A skill in “Anchor” must be shielded from efficiency pressures that would erode its developmental value.

Figure 3. Automation and Augmentation Scores: Intermediating Skills



The Deeper Paradox

One pattern deserves emphasis: as AI automates execution, the cognitive demands on humans often rise.

Writing is a prime example. AI can generate a polished draft in seconds, but it bypasses the very struggle that generates intellectual growth: rethinking a claim that felt solid, discovering a logical hole mid-sentence, pushing past an easy answer. Writing isn't just a communication skill; it's a form of reasoning. A student who starts from AI output may learn to edit, but never to think through prose.

Similarly, AI can now solve equations and show its work. But the cognitive effort of mathematical reasoning—choosing an approach, recognizing when a method doesn't fit, understanding why a solution works—is how quantitative thinking develops. A student who copies AI's steps may get the right answer but never build the intuition to tackle unfamiliar problems.

This logic applies wherever judgment is the core of the skill, such as with strategic planning, problem-solving, and ethical reasoning. In this framework, judgment is the capacity to evaluate quality, recognize appropriateness to context, weigh trade-offs between competing goods, and

make defensible decisions when rules don't provide clear answers. It develops through repeated practice making consequential choices and receiving feedback—not through memorizing criteria.

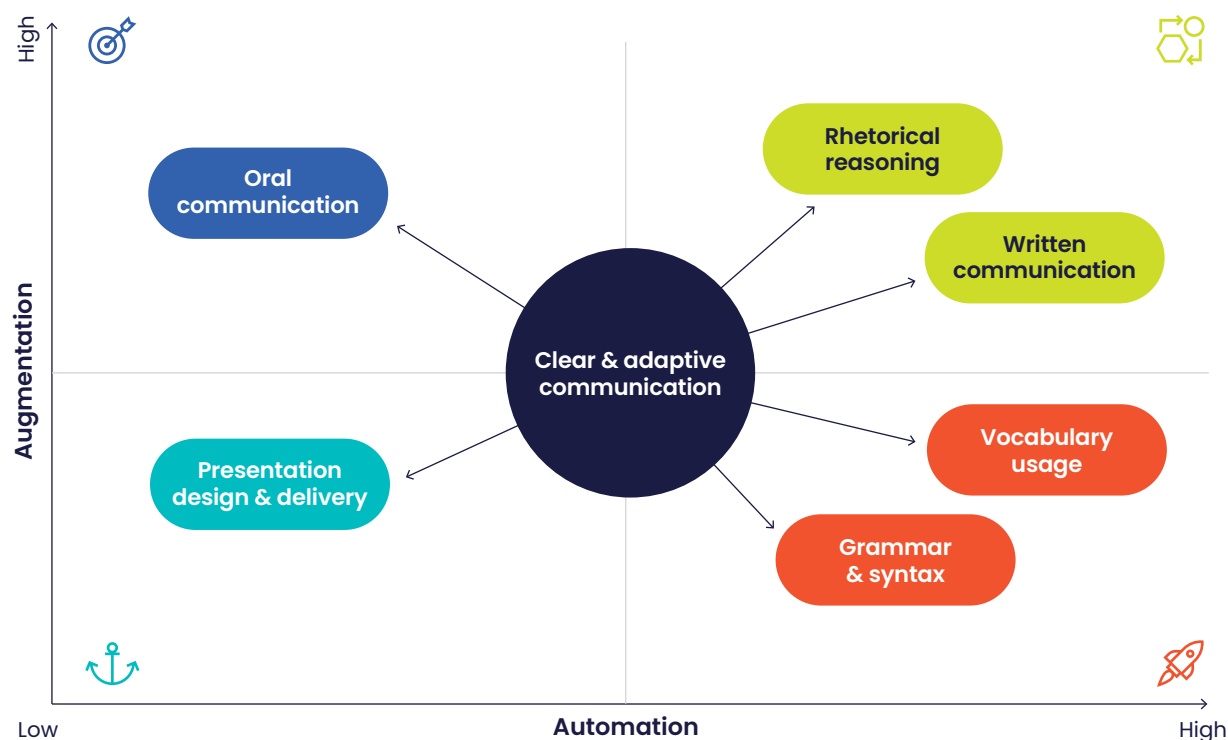
This reveals the central paradox of the AI era: **execution can be automated, but thinking cannot.** As AI absorbs more routine execution, the burden on human judgment, critical thinking, strategic synthesis, and conceptual understanding grows heavier, not lighter. This insight becomes the absolute foundation for responsible and effective use.

A 2025 **Burning Glass Institute and Harvard Business School report** found that many of the highest-value careers will come to demand greater levels of proficiency as AI reduces time spent on routine functions and accentuates the premium on expertise. New graduates will be expected to possess advanced skillsets from day one, rather than accruing judgment and critical thinking on the job. This challenges educators to prepare students to start their careers not in the beginning but in the middle.

Far from reducing workers to automata, AI's more likely effect will be to raise the bar, demanding that humans operate at a higher cognitive level.

What makes this framework actionable is that any single learning objective draws on a portfolio of skills that are affected by AI in profoundly different ways. Understanding this interplay is what reveals where instructional priorities must shift. Consider the English Language Arts competency "Develop clear and adaptive communication." This single objective is illustrated by the four quadrants below:

Figure 4. Example of How AI Exposure of Intermediating Skills Varies Within a Single Learning Objective



- In the **Anchor** quadrant (low automation, low augmentation), we find foundational skills like **Presentation Design & Delivery**. The essential human work of structuring a compelling narrative, shaping a core thesis, and delivering it with presence remains a cornerstone of communication, largely untouched by AI. These skills anchor the entire objective in authentic human interaction.
- Conversely, skills in the **Streamline** quadrant (high automation, low augmentation) are highly automatable—in this case, correcting **grammar and syntax**, and **optimizing vocabulary**. These skills are still important but some of the typical drill-based instruction can be shifted toward practicing these skills in the context of writing.
- Moving to the top half of the framework, the **Deepen** quadrant (low automation, high augmentation) highlights skills where AI acts as a performance coach. **Oral communication**, for example, cannot be automated. However, AI tools can augment a learner's practice by providing sophisticated, real-time feedback on pacing, tone, and clarity, helping them deepen their own abilities far more efficiently.
- Finally, the **Transform** quadrant (high automation, high augmentation) is where human-AI collaboration fundamentally changes the work. **Writing and reasoning** already feature prominently in today's curricula and will be no less important in the future. However, their practice is being transformed. AI can automate first drafts while also augmenting a writer's strategic process, suggesting novel arguments or rhetorical approaches. This demands new modes of instruction as the human's role shifts from simple creator to creative director, guiding AI to scale their own ingenuity and critical judgment.

This pattern repeats across disciplines. In the sections that follow, we unpack each quadrant in detail and then show how the framework applies to each subject area, identifying which intermediating skills warrant rebalancing.

SECTION III:

Mastering The Framework — How Skills Fit in Four Quadrants

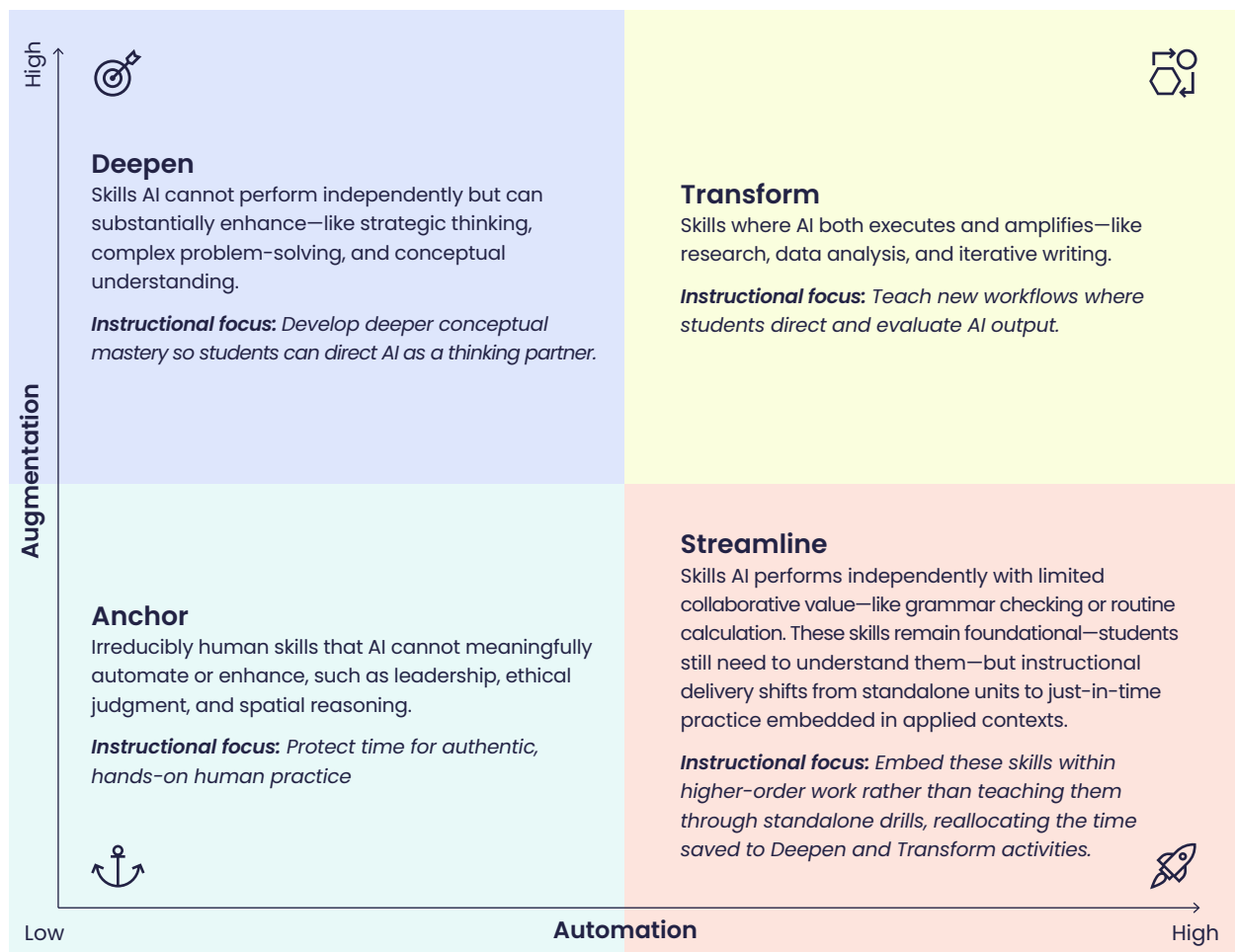
This framework emerges from rigorous analysis of over 140 learning objectives and 1,000 workforce skills. We mapped each intermediating skill to its automation and augmentation potential, identified clusters and patterns, and validated the resulting categories against real classroom and workplace constraints.

The four quadrants plot each intermediating skill according to its automation and augmentation scores. Each quadrant is named for the instructional response these dynamics demand: **Deepen** conceptual mastery, **Transform** the workflow, **Streamline** by embedding in higher-order work, or **Anchor** in authentic human practice. (Refer to Figure 5 below for the quadrant map.)

What makes this framework actionable is that every learning objective contains multiple intermediating skills, each falling into different quadrants. A single standard like “Demonstrate the ability to analyze, justify, and evaluate mathematical arguments” draws on skills with widely varying AI exposure—some that resist automation, some that benefit from AI assistance, some that AI can execute reliably. How these skills relate to each other within a learning objective reveals where instructional priorities should shift.

The quadrants share a common logic: all four involve rebalancing instructional time. But how? Some skills need more conceptual depth and less procedural drilling. Some require entirely new workflows where students direct AI rather than execute tasks alone. Some shift from standalone instruction to embedded practice within applied contexts. And some must be protected from efficiency pressures that would erode their developmental value. Across all four quadrants, the fundamental shift is where and how instructional time is spent.

Figure 5. Instructional Cues for the Four Quadrants



Quadrant 1: DEEPEN (Low Automation / High Augmentation)

Instructional focus: Same workflow, deeper understanding—so students can use AI as a thinking partner.

These skills cannot be automated; they demand human performance. But in an AI-augmented workforce, mastery requires something different from before: deeper conceptual understanding of the principles underlying the skill, so workers can direct AI effectively, recognize when its suggestions are sound versus misleading, and know when to override the machine.

Why deeper understanding matters: The workflow itself doesn't fundamentally change—students still think critically, speak persuasively, negotiate, lead. But mastery increasingly requires seeing the reasoning beneath the performance, not just executing the performance itself. A negotiator must understand negotiation principles deeply enough to evaluate tactical suggestions and adapt when conditions shift. A leader must grasp systems thinking thoroughly enough to recognize

when organizational analysis is sound versus flawed. When augmentation tools can generate options at scale, human judgment becomes the bottleneck—and that judgment requires conceptual depth students can't build through procedural practice alone.

Examples: Creativity and innovation, oral communication, probabilistic thinking, evidence evaluation.

Key Principle: Push for deeper conceptual understanding so students can direct and evaluate AI augmentation. Mastery shifts beyond merely executing tasks to include a sound grasp of the principles that guide them.

How Deepen differs from Transform: For skills in the Transform quadrant (below), the workflow itself changes as AI executes significant portions of tasks. For skills in Deepen, the workflow remains essentially the same. What changes is the depth of conceptual understanding required to effectively leverage AI augmentation.

Quadrant 2: TRANSFORM (High Automation / High Augmentation)

Instructional focus: Prepare students for a new workflow in which they become directors and editors of AI output instead of solo executors.

Here, AI both executes significant portions of the task and amplifies human capability in the complex portions that remain. The workflow fundamentally changes—what students do, how they do it, and what counts as mastery all shift.

Why the workflow transforms: The human role shifts to directing the work, evaluating output quality, making trade-offs, verifying results, and deciding what to accept, reject, or rebuild. The student becomes a supervisor, quality arbiter, and strategic thinker. This represents a fundamentally different kind of performance—one where success depends on judgment about quality, strategic decisions about approach, and the ability to verify whether generated output actually solves the problem at hand. Students must understand domain principles deeply enough to recognize what constitutes good work, not just how to produce it.

Just as AI transforms how these skills are used, it also reshapes how they must be taught. Students still engage in rigorous cognitive work, but they learn in part by directing AI, deciding whether an AI draft captures their idea, revising when it doesn't, and explaining why their version is better.

Examples: Analytical writing, research design and planning, data gathering and analysis, presentation design, written communication, quantitative modeling, statistical reasoning.

Key Principle: These skills require the biggest instructional shift. Students still write, analyze, and design, but do so as directors of AI work and as judges of quality, not as solo executors.

Quadrant 3: STREAMLINE (High Automation / Low Augmentation)

Instructional focus: Shift from standalone instruction to embedded practice within higher-order work.

Of the four quadrants, Streamline often requires the most careful explanation. The framework suggests not eliminating foundational skills, but fundamentally changing how and when they are taught. Because this shift is both pedagogically significant and easily misinterpreted, we unpack it here in greater detail.

Streamline skills follow rule-based patterns that students can learn efficiently in applied contexts. These are not skills to cut from the curriculum—most are foundational prerequisites for advanced learning. Rather, the balance of instructional time may shift significantly. This is a structural rebalancing of when and where skills are taught, moving from extended standalone units to targeted, just-in-time instruction embedded within the authentic, higher-order work where they are needed.

The strategic move is consolidation: fold these skills into the higher-order work they support. Shift grammar practice into units on writing, instead of primarily before it. Hone algebraic fluency within units on quantitative modeling, rather than as an end in itself. Teach logic through argumentation, not primarily as isolated exercises. The skill doesn't disappear from curriculum; it shifts from being the end of instruction to being practiced in service of more sophisticated, complex skills.

Why this shift makes sense pedagogically: These skills are rule-governed and procedural, which makes them highly teachable in context. That's also why they're teachable in context. A grammatical concept is best taught when a student encounters a problem in their own writing; the need for algebraic manipulation arises when a model requires it. The skill surfaces when it's needed, which is when it's most learnable. As students rely increasingly on AI for execution, they need enough foundational understanding to spot errors, but not the same volume of isolated practice that built fluency in a pre-AI era.

Where the instructional time goes: Multi-week standalone units are compressed into targeted lessons. Isolated assessments get replaced by formative checks within applied work. Drill-based practice disconnected from application is reduced. The reclaimed time is reallocated to skills that fall within the framework's Deepen and Transform quadrants, where the pedagogical challenges are harder and the payoff is higher. Students spend less time on grammar worksheets and more time on rhetorical judgment, less time on algebraic manipulation drills and more time on mathematical modeling, less time memorizing vocabulary lists and more time reading complex texts where they encounter words in context.

Examples: Grammar and syntax, algebraic fluency, formal and informal logic, vocabulary usage, estimation and approximation.

Key Principle: These skills shift from being ends in themselves to being practiced in service of higher-order work. The foundational knowledge remains essential; what changes is the instructional delivery. Reduce standalone instruction to a supporting role, using it primarily for two key functions: introducing concepts and providing targeted interventions. Consolidate practice into the complex skills these foundations serve, and reallocate the time saved to Deepen and Transform activities.

Quadrant 4: ANCHOR (Low Automation / Low Augmentation)

Instructional focus: Protect time for authentic, hands-on human practice.

These skills develop only through authentic performance and lived consequences—the learning happens through doing, not through instruction about doing. AI might offer peripheral support, but the core work remains irreducibly human. Whether it’s a leader’s judgment, an artist’s vision, a surgeon’s hands, or a researcher’s integrity, these capabilities cannot be outsourced without destroying the learning itself. Tools might help—a surgeon can use imaging software, an artist can iterate with digital mockups, a leader can toggle through dashboards—but the core work remains human. These are the skills where the value lies in ownership, persistence, and character.

Examples: Ethical reasoning, civic literacy and participation, causal inference, critical reading, experimental design, metacognition and self-regulation, spatial reasoning, troubleshooting.

Key Principle: Protect the space for learning. These skills develop through hands-on practice in which students make real decisions and experience real consequences. AI stays in the background.

From Framework to Practice: What Comes Next

The four quadrants provide a coherent lens for understanding how AI reshapes what students need to learn. But understanding the framework is different from using it.

The real work begins when educators take a specific learning objective and ask: What intermediating skills does this require? Which are automatable? Which benefit from AI augmentation? How does that reshape what I teach?

That’s where the framework becomes diagnostic. Section IV provides a practical guide for this work, walking through how to map a learning objective to its intermediating skills and translate that analysis into concrete instructional moves.

The framework is not prescriptive—it is a system for thinking clearly about trade-offs. The specific choices you make will depend on your students, constraints, and pedagogical priorities. The four quadrants give you a rigorous way to make those choices visible and defensible.

Beyond the Quadrants: A Lens for Nuanced Interpretation

The four-quadrant framework provides a high-level strategic map for guiding curriculum development. Yet some may question if such a broad tool can navigate the complexities of instruction, especially when a learning objective involves a cluster of skills with ambiguous priorities. This section addresses that concern by demonstrating how to look within the quadrants for a deeper, more nuanced layer of analysis.

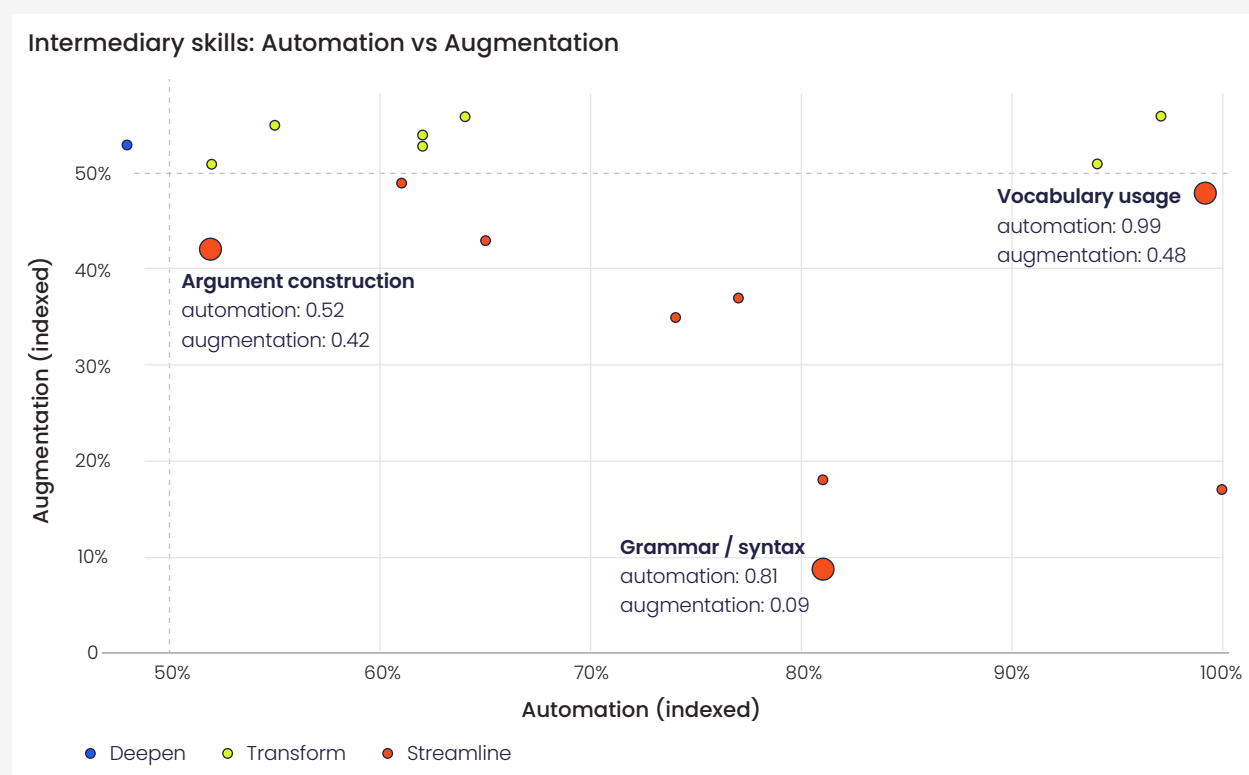
The quadrants are not rigid boxes but zones on a continuous spectrum. A skill's general location—whether it sits deep within a quadrant or near a border—can illuminate its “character” and spark more sophisticated conversations about where human attention is most valuably directed.

An Illustration: The Different “Characters” of Streamline Skills

To illustrate this concept, consider three intermediating skills from the Streamline quadrant related to the learning objective “Develop coherent and clear texts.” While they all fall under the same category, their relative positions suggest distinct strategic considerations. The coordinates provided below are from one specific analysis and serve only to illustrate this principle of relative positioning.

- **Grammar/syntax (automation: 0.81, augmentation: 0.09):** Positioned deep within the quadrant with a very high automation score and a very low augmentation score, this skill is a quintessential candidate for offloading more rote instruction efforts. Its location suggests that rule-based conventions can be reliably handled by AI. This positioning could free up significant cognitive resources, allowing students to focus less on mechanical correctness and more on the clarity, style, and persuasive impact of their ideas.
- **Argument construction (automation: 0.52, augmentation: 0.42):** In contrast, this skill sits much closer to the center of the framework, with moderate scores on both the automation and augmentation axes. This position near the border of other quadrants indicates its complexity. While AI can assist with basic structures, the skill remains fundamentally human-centric. This suggests an opportunity to use AI not as a replacement, but as a collaborative partner for exploring structural options, freeing instructors to focus on developing students' capacity to generate original claims and evaluate evidence.
- **Vocabulary usage (automation: 0.99, augmentation: 0.48):** This skill's position is distinctive: it has one of the highest possible automation scores but also a strong augmentation score, placing it near the border of the Transform quadrant. This placement implies a strategic shift away from rote memorization. Instead of isolated vocabulary drills, instructional time could be reallocated toward authentic reading and writing, where students use AI as a tool to explore nuanced, contextually appropriate language and develop a more sophisticated relationship with word choice.

Figure 6



The stark differences among these three “Streamline” skills demonstrate that while the four quadrants provide the essential strategic direction, this deeper analysis can be helpful when more subtlety is required. Ultimately, this level of detail is not about prescribing definitive answers. It is about demonstrating how the framework can be used as a flexible thinking tool to refine the finer points of curriculum design and instructional strategy.

SECTION IV:

The Framework in Practice

Most learning standards were written before mainstream generative AI existed. They bundle together multiple distinct skills that AI now affects very differently—some that AI can automate, some that AI can meaningfully augment, and some where AI plays little or no role at all.

This section explores how this framework can be applied to core learning standards across different subject areas. The subject analyses below demonstrate one application of this framework, based on our team’s analysis as of early 2025. The intermediating skills, quadrant placements, and instructional recommendations are illustrative examples meant to demonstrate the thinking process—not prescriptive answers for every district. Your own analysis may produce different results based on local context, student needs, specific standards, and evolving AI capabilities.

Note on Streamline skills: Streamline skills are listed in each quadrant table—grammar, procedural fluency, variable identification, research mechanics. These appear because they’re genuinely part of the standard and remain foundational prerequisites for advanced learning. The key instructional shift is structural rebalancing: move these skills from standalone units to just-in-time instruction embedded within the higher-order work they support. When you see a skill marked Streamline, that’s a signal to consolidate practice into complex, applied contexts rather than teaching it primarily as an isolated unit. The reclaimed instructional time should be reallocated to Deepen and Transform skills.

How We Applied the Framework

Step 1 — Select a Learning Standard

We chose a learning standard recognized at the state or national level from a core subject area.¹ For example:

CCSS.ELA-Literacy.W.9-10.1 — Write arguments to support claims in an analysis of substantive topics or texts.

¹ While Section I analyzes Learning Objectives—synthesized from learning standards across 21 representative US states—most teachers work from their own state or district standards in practice. The process is the same: the intermediating skills you identify in Step 2 function as the learning objectives to which the quadrant framework applies.

Step 2 — Identify the Intermediating Skills

We then broke the standard into its intermediating skills. Most standards contain 3–6 distinct skills.

Step 3 — Place Each Skill in Its Quadrant

To determine whether the skill requires Deepening, Transforming, Streamlining, or Anchoring, we then mapped each skill's quadrant positioning using its AI automation and augmentation exposure scores.

Step 4 — Redesign Instruction Based on Quadrant Placement

Based on quadrant placement, we designed instructional approaches that: increase time on Deepen skills; redesign workflows for Transform skills; embed and consolidate Streamline skills within higher-order work; and create authentic performance tasks for Anchor skills, adjusting assessment to reflect these priorities.

Applying the Framework Across Core Subjects

To demonstrate this process in action, the following sections apply the framework to core content areas. Each analysis begins by identifying **(1) a representative learning standard** and **(2) its best-matching learning objective** from this paper's research. We then break that standard into its **(3) intermediating skills** and present **(4) a quadrant placement table** with rationales for each placement. Finally, we offer **(5) ideas for a revised instructional approach** with actionable strategies for the Deepen, Transform, Streamline, and Anchor quadrants.

This consistent structure is designed to help educators see how the framework's logic adapts to the unique demands of each discipline.

English Language Arts (ELA)

Learning Standard

CCSS.ELA-Literacy.W.9-10.1 — Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

(Citation: Common Core State Standards for ELA.)

Best-Matching Learning Objective:

Develop coherent and clear texts appropriate for various purposes, including argumentative and persuasive writing; informative and explanatory writing; narrative and creative writing.

Intermediating skills:

- Analytical writing
- Argument construction
- Creativity and innovation
- Grammar and syntax
- Rhetorical reasoning
- Written communication
- Vocabulary usage

Additional intermediating skills to consider:

- Critical reading
- Evidence evaluation
- Active listening and dialogue

Quadrant Placement

Skill	Quadrant	Rationale
Analytical writing	<i>Transform</i>	Analytical writing requires breaking down complex texts, identifying patterns and literary devices, and constructing interpretive arguments—a process that can be significantly augmented by AI tools that surface textual evidence, suggest organizational structures, and demonstrate how to build interpretive claims from close reading. This creates a Transform workflow where students direct the analysis and use AI to explore interpretive possibilities and refine their reasoning.

Skill	Quadrant	Rationale
Argument construction	<i>Streamline</i>	Argument construction follows established organizational patterns (claim, evidence, reasoning, counterargument) that AI can reliably generate and structure. This allows students to focus their cognitive energy on the quality and originality of their claims rather than the mechanics of organization. Foundational understanding of argumentative structure remains important for directing AI effectively and recognizing structural weaknesses, but dedicated instructional time can be reallocated to higher-order reasoning.
Creativity and innovation	<i>Deepen</i>	Creative argumentation requires generating original insights, making unexpected connections, and developing a distinctive intellectual voice—capabilities that deepen through practice and risk-taking. AI can offer conventional suggestions, but it struggles to produce genuinely novel ideas or authentic voice, making this a quintessential Deepen skill: instruction must focus on cultivating students' creative confidence and judgment.
Grammar and syntax	<i>Streamline</i>	Grammar and syntax follow rule-based conventions that can be automated reliably by AI, allowing students to focus their cognitive energy on higher-order concerns like the clarity and persuasiveness of their ideas. This is a quintessential Streamline skill: foundational understanding remains important for error-catching, but dedicated instructional time can be reallocated to skills AI cannot automate.
Rhetorical reasoning	<i>Transform</i>	Rhetorical reasoning involves understanding how language choices shape audience perception and persuasiveness—a skill that can be significantly augmented by AI tools that analyze rhetorical appeals, suggest alternative phrasings, and model different tones for specific audiences. This creates a Transform workflow where students use AI to explore rhetorical options and refine their strategic choices.
Written communication	<i>Transform</i>	Written communication involves translating complex ideas into clear, audience-appropriate prose—a process that can be augmented by AI at multiple stages, from initial drafting to stylistic refinement. This creates a Transform workflow where students focus on high-level decisions about purpose, audience, and message while using AI to generate options, test different approaches, and refine clarity. The student's role shifts from sole author to strategic director and critical editor.

Skill	Quadrant	Rationale
Vocabulary usage	<i>Streamline</i>	Vocabulary usage involves selecting precise, contextually appropriate words—a task AI can reliably automate through synonym suggestions and contextual alternatives. Foundational understanding of word meaning and connotation remains important for evaluating AI suggestions, but dedicated instructional time can be reallocated from vocabulary drills to higher-order skills. Students should develop vocabulary through authentic reading and writing experiences, using AI to refine and expand their word choices in context.
Critical reading	<i>Anchor</i>	Critical reading is the foundational act of wrestling with a text's meaning, subtext, and intent—a cognitive dialogue between reader and author's world. This skill develops through sustained engagement with complex texts—identifying perspective, wrestling with contradictions, making connections across contexts. Students build this capacity through repeated practice with challenging texts that resist easy interpretations.
Evidence evaluation	<i>Deepen</i>	Evidence evaluation requires contextual judgment about a source's credibility, bias, and relevance to a specific argument—expertise that deepens with domain knowledge and critical reading practice. Students must develop stronger evaluative skills because they will encounter larger volumes of sources and need the discernment to distinguish reliable evidence from confidently presented but unreliable information. This judgment develops through repeated practice evaluating sources within specific argumentative contexts.
Active listening and dialogue	<i>Anchor</i>	Active listening and dialogue require real-time processing of others' ideas, empathetic engagement with opposing viewpoints, and the ability to build collaboratively on others' contributions—skills that must be practiced in authentic interpersonal contexts. These capacities develop through the dynamic, embodied experience of listening to a peer, reading non-verbal cues, and adapting one's thinking in response to genuine human dialogue. This cannot be simulated; it requires repeated practice in live conversation where students experience the reciprocal nature of collaborative thinking.

Revised Instructional Approach

Traditional English instruction centers on drafting essays from scratch, writing multiple revisions, and polishing final products, distributing time relatively evenly across mechanics, organization, idea development, and revision. Because AI now handles much mechanical and organizational work reliably, instruction must reallocate time toward skills that remain irreducibly human or that require new forms of judgment in AI-mediated workflows.

Deepen: Prioritize Originality, Voice, and Evidence Quality

Why this matters: In an information-rich environment, the ability to synthesize, evaluate, and create becomes paramount. This emphasis pushes students up the cognitive ladder from understanding and applying to analyzing and creating. Developing an original perspective and the critical judgment to defend it are essential skills for navigating complex problems and contributing meaningfully in any field.

Instructional shifts:

- **Increase time on intellectual risk-taking.** Teach students to develop counterintuitive claims, challenge conventional interpretations, and pursue original lines of argument. Reduce time on thesis statement structure; increase time on what makes claims interesting and defensible.
- **Deepen evidence evaluation.** Students need stronger skills assessing credibility, bias, and relevance because they will work with larger volumes of sources requiring critical evaluation. Shift from teaching citation mechanics to teaching critical evaluation of sources.
- **Build oral argumentation capacity.** Live defense of ideas—responding to challenges, adapting arguments dynamically, reading audience response—cannot be outsourced. Increase frequency of unscripted Socratic seminars, oral defenses, and discussion-based assessment.

Transform: Teach Strategic Revision and Rhetorical Decision-Making

Why this matters: Writing workflows now involve generating options, evaluating alternatives, and making strategic choices about voice, structure, and appeals. Students must learn to verify, challenge, and build upon analytical claims—whether self-generated, found in sources, or produced through collaborative tools.

Instructional shifts:

- **Assess process, not just product.** Evaluate students' decision-making: Why did they choose this structure over alternatives? How did they refine initial drafts? What criteria drove their revision choices? This develops strategic judgment about writing.
- **Teach rhetorical choice through comparison.** Present students with multiple versions of arguments (different structures, appeals, tones) and have them analyze trade-offs. Increase time spent evaluating options; decrease time spent on singular "correct" approaches.
- **Emphasize analytical interpretation over summary.** Students must learn to verify, challenge, and build upon analytical claims—whether self-generated, found in sources, or produced through AI or other collaborative tools. Teach close reading as an evaluative skill: students should practice examining how texts construct arguments, not just extracting what they say.

Streamline: Automate Mechanics to Reclaim Time for Deeper Work

Why this matters: Correcting mechanical errors consumes significant cognitive overhead—mental energy that is better spent on critical thinking. By empowering students to use tools as partners for refining grammar, syntax, and structure, we free them to invest their full intellectual capacity where it counts most: analyzing evidence, wrestling with complex ideas, and crafting original insights. This isn't about skipping the fundamentals; it's about managing them more effectively to unlock higher levels of achievement.

Instructional shifts:

- **Embed grammar and vocabulary instruction in authentic writing.** Teach these skills when they surface in students' own writing rather than through standalone units. Shift from decontextualized drills to just-in-time instruction during revision, where students immediately see why the skill matters.
- **Assess mechanics within rhetorical contexts.** Evaluate whether students make effective rhetorical choices and use grammatical structures purposefully to achieve their goals, rather than grading mechanics separately from meaning. Shift from formulaic rubrics to holistic assessment of how well conventions serve the writer's purpose.
- **Reduce time on outlining and organization.** Teach structural concepts quickly; spend reclaimed time on claim development and evidence quality.

Anchor: Protect Deep Reading and Collaborative Dialogue

Why this matters: Close reading of complex texts and authentic dialogue with peers develop capacities that emerge only through direct engagement. Comprehension deepens through the struggle of parsing difficult prose; collaborative reasoning develops through the reciprocal exchange of live discussion. These experiences cannot be replaced without eliminating the learning they produce.

Instructional shifts:

- **Require regular independent close reading.** Students must practice extracting meaning from difficult texts—identifying rhetorical moves, tracing arguments, grappling with ambiguity—without external support. This builds foundational interpretive capacity through the struggle itself.
- **Increase unscripted discussion.** Socratic seminars, deliberations, and live debates develop active listening, collaborative reasoning, and adaptive thinking. These must happen in real time with real peers.
- **Assess depth of textual engagement.** Evaluate whether students notice textual complexity, not just whether they comprehend main ideas. Annotated readings, interpretive essays, and discussion contributions should demonstrate nuanced engagement with language and ideas.

Mathematics

Learning Standard

CCSS.Math.Content.HSA-REI.C.6 — Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

(Citation: Common Core State Standards for Mathematics, Algebra — Reasoning with Equations & Inequalities.)

Best-Matching Learning Objective:

Solve equations and inequalities, including systems of linear and nonlinear equations.

Intermediating skills:

- Algebraic fluency
- Computational thinking
- Estimation and approximation
- Functional and graphical thinking
- Mathematical problem-solving

Additional intermediating skills to consider:

- Probabilistic thinking

Quadrant Placement

Skill	Quadrant	Rationale
Algebraic fluency	<i>Streamline</i>	Algebraic fluency involves applying procedural rules for manipulating symbols and solving equations—skills that follow algorithmic patterns. Students need sufficient fluency to recognize when algebraic techniques apply and to verify whether results make sense, but extensive drill-based practice can now be replaced with practice in applied contexts where students use algebra to model real situations and interpret solutions.
Computational thinking	<i>Transform</i>	Computational thinking involves decomposing problems into algorithmic steps, recognizing patterns in procedures, and understanding the logical structure of mathematical processes—skills that can be significantly augmented by AI tools that execute algorithms reliably while making each step transparent. This creates a Transform workflow where students focus on understanding the logic and structure of solution methods (e.g., “Why does this sequence of operations solve the equation?”) while using AI to execute and verify the steps. The student’s role shifts from manual computation to algorithmic understanding and strategic oversight.

Skill	Quadrant	Rationale
Estimation and approximation	<i>Streamline</i>	Estimation and approximation follow heuristic rules (rounding, order-of-magnitude thinking) that AI can apply quickly and consistently. While students need conceptual understanding of when and why to estimate, the mechanical execution of estimation strategies can be automated, freeing time for students to focus on interpreting whether their estimates make sense in context and whether exact solutions are necessary.
Functional and graphical thinking	<i>Transform</i>	Functional and graphical thinking involves understanding relationships between variables and their visual representations—skills that can be significantly augmented by AI tools that generate graphs instantly, explore transformations dynamically, and model functional behavior. This creates a Transform workflow where students focus on interpreting patterns, making conjectures about relationships, and connecting multiple representations while AI handles the computational and graphical mechanics.
Mathematical problem-solving	<i>Anchor</i>	Mathematical problem-solving requires recognizing problem types, selecting appropriate strategies, and persevering through uncertainty—metacognitive skills that develop through authentic struggle with challenging problems. This problem-solving disposition, strategic thinking, and resilience emerge only when students wrestle with difficult problems independently, experiencing the productive frustration of being stuck and the satisfaction of breakthrough. This capacity cannot be built by watching solutions appear; it requires repeated practice at the edge of one's understanding.
Probabilistic thinking	<i>Deepen</i>	While equation-solving is often taught as a deterministic process with exact answers, probabilistic thinking becomes essential when students work with equations in real-world contexts. Systems of linear and nonlinear equations frequently involve parameters with inherent uncertainty or variability—from physics problems with measurement error to economic models with fluctuating variables. Students need to understand when solutions are approximate versus exact, evaluate which solutions are feasible given constraints, and reason about how sensitive solutions are to changes in parameters. With nonlinear systems that may have zero, one, or multiple solutions, probabilistic thinking helps students determine which solutions are most likely or relevant in practical contexts.

Revised Instructional Approach

The value in solving equations has shifted from the calculation of the answer to the formulation of the problem and the interpretation of the result. Since AI tools can flawlessly execute the mechanical steps of solving for a variable, instructional time must be reallocated. The focus now is on translating complex, real-world scenarios into precise mathematical models (the systems of equations) and, after solving, making sense of the solution within its original context. The goal is to develop problem architects and strategic thinkers.

Transform: Teach Algorithmic Understanding and Multi-Representational Thinking

Why this matters: Students no longer need to execute computations manually, but they must understand the logical structure of solution methods and how different representations connect. The cognitive work shifts from calculation to interpretation.

Instructional shifts:

- **Teach computational thinking, not computation.** Students should understand why solution methods work and when to apply them, not just how to execute steps. This includes investigating edge cases where methods fail or produce unexpected results—understanding why an algorithm breaks down reveals its underlying logic. Increase time analyzing algorithmic reasoning; decrease time on manual calculation practice.
- **Emphasize connections across representations.** Students must learn to move fluidly between symbolic, graphical, and numerical forms—interpreting what each reveals and how changes in one affect the others. Reduce time creating graphs by hand; increase time interpreting patterns across representations.
- **Build verification and error detection skills.** Students must learn to recognize when solutions are incorrect and diagnose why. This includes analyzing when solution methods fail—exploring cases where standard approaches break down or produce invalid results—to understand the boundaries and limitations of different techniques. Regular analysis of flawed solutions develops critical evaluation capacity.

Streamline: Embed Procedures in Applied Problem-Solving

Why this matters: Procedural skills like symbolic manipulation and estimation follow algorithmic rules that students can now learn efficiently in applied contexts. These remain foundational but no longer require the extensive standalone practice that once built fluency—students develop procedural competence through use in problem-solving contexts where they see why procedures matter.

Instructional shifts:

- **Embed procedural practice in problem-solving contexts.** Reduce problem sets focused solely on technique mastery. Students need enough practice to understand procedures and recognize when to apply them, but fluency now develops through use in authentic problems rather than through isolated repetition.
- **Shift focus to mathematical modeling.** Increase time spent translating real-world situations into mathematical form and interpreting solutions in context. The hard cognitive work is setup and interpretation, not calculation.
- **Teach estimation as verification, not as technique.** Students should learn to check whether answers are reasonable, not to practice estimation algorithms. Embed this as a metacognitive habit within problem-solving.

Anchor: Protect Non-Routine Problem-Solving Practice

Why this matters: Problem-solving disposition—recognizing problem types, trying multiple approaches, persevering through difficulty—develops only through authentic struggle with challenging problems. This capacity emerges from repeated experience wrestling with problems at the edge of understanding, experiencing productive frustration, and discovering solution paths through persistence.

Instructional shifts:

- **Regularly assign problems AI cannot solve easily.** Non-routine problems that require pattern recognition, creative approaches, or synthesis across concepts build problem-solving capacity. These should be attempted without AI assistance.
- **Assess process, not just answers.** Evaluate students' problem-solving strategies, their ability to try multiple approaches, and their metacognitive awareness of what's working and what isn't.
- **Include problem-posing activities.** Having students create their own challenging problems deepens understanding of mathematical structure and develops strategic thinking about problem types.

Deepen: Analyze System Behavior and Constraints

Why this matters: Real-world problems are not static. The most valuable human skill is not just solving a given equation but understanding how the solution changes when the conditions of the problem change. This requires students to analyze the behavior of the mathematical model itself, a form of dynamic reasoning that AI assists but does not lead.

Instructional shifts:

- **Teach sensitivity and parameter analysis.** Move beyond finding single solutions to understanding how and why solutions vary. Ask questions like: “How much can this coefficient change before the solution becomes non-viable?” or “Which variable has the biggest impact on the outcome?” This shifts focus from finding an answer to understanding the system’s behavior.
- **Introduce optimization under constraints.** Present problems that have multiple possible solutions and require students to find the best one based on real-world constraints (e.g., minimizing cost, maximizing output, staying within a budget). This develops judgment and decision-making skills.
- **Explore model robustness and limitations.** Challenge students to identify the breaking points of a model. Ask: “Under what conditions or assumptions does this model fail?” or “What real-world factors does our system of equations not account for?” This builds critical awareness that all models are simplifications—understanding the gap between model and reality is essential mathematical maturity.

Science

Learning Standard

NGSS HS-LS1-3 — Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

(Citation: Next Generation Science Standards, High School Life Science 1.)

Best-Matching Learning Objective:

Plan and carry out scientific investigations (descriptive, comparative, experimental).

Intermediating skills:

- Data cleaning and preparation
- Data collection methods
- Evidence evaluation
- Experimental design
- Measurement and uncertainty analysis
- Research design and planning
- Statistical reasoning

Additional intermediating skills to consider:

- Information literacy

Quadrant Placement

Skill	Quadrant	Rationale
Data cleaning and preparation	<i>Transform</i>	Data cleaning requires understanding what constitutes valid data for a particular analysis. While AI can execute standardized cleaning procedures, students must decide which data points to include or exclude, how to handle outliers that may represent real phenomena versus errors, and whether cleaned data still meaningfully represents the original context.
Data collection methods	<i>Transform</i>	Designing data collection requires understanding what variables to measure and how, but the actual logging is often repetitive and time-consuming. Students can focus on strategic design decisions while AI-powered sensors and automated systems handle high-frequency or large-scale data capture, enabling investigations previously limited by manual collection constraints.

Skill	Quadrant	Rationale
Evidence evaluation	<i>Deepen</i>	Evaluating evidence is an essential cognitive skill. It requires students to critically assess the methodology behind a scientific claim, identify logical fallacies, judge the strength and relevance of data, and determine whether conclusions are truly warranted. AI can present evidence, but the human must perform the critical judgment of its quality and meaning.
Experimental design	<i>Anchor</i>	Designing valid experiments requires conceptual understanding of cause and effect, ability to identify confounding variables, and creative problem-solving to control them—thinking that develops through grappling with real constraints. Students must develop the judgment to recognize why a design is fundamentally sound or fatally flawed, which requires wrestling with the tension between what they want to test and what they can actually control in a real laboratory environment. This judgment develops through repeated practice designing investigations and encountering the consequences when designs fail.
Measurement and uncertainty analysis	<i>Anchor</i>	The physical act of taking measurements and understanding their potential inaccuracies requires real-world interaction. Students must develop judgment about sources of systematic and random error through hands-on laboratory work—experiencing how equipment limitations, environmental conditions, and procedural variations affect data quality. Calculating uncertainty from a dataset is straightforward; recognizing why that uncertainty exists and what it means for conclusions requires embodied experience with measurement tools and processes.
Research design and planning	<i>Transform</i>	AI can act as a powerful assistant in structuring a research project. It can help generate literature reviews, formulate procedural steps, and create project timelines. This transforms the student's role from a lone planner to a project manager who leverages AI to build a more comprehensive and rigorous research plan.
Statistical reasoning	<i>Transform</i>	AI can perform complex statistical analyses in seconds, automating calculations that were once a major barrier. This transforms the student's role from performing calculations to selecting the appropriate statistical test for their hypothesis, interpreting the AI-generated output (e.g., p-values, confidence intervals), and explaining the significance of the results.
Information literacy	<i>Streamline</i>	Locating relevant scientific literature and datasets is largely procedural: knowing where to search and what keywords to use. AI can handle this retrieval efficiently, allowing instruction to embed source-finding within authentic research work rather than practicing it in isolation, with instructional focus shifting to what students do with sources once found.

Revised Instructional Approach

Traditional science instruction emphasizes following predetermined procedures and manually recording observations, with students spending significant time on data entry, graph creation, and formulaic lab report writing. Because AI now handles data management and retrieval efficiently, instruction must reallocate time toward experimental design, evidence evaluation, and scientific reasoning—skills that require hands-on experience and critical judgment. The goal is to shift students from being technicians who follow procedures to scientists who design investigations and critique claims.

Deepen: Build Evidence Evaluation and Experimental Judgment

Why this matters: Students must learn to distinguish rigorous evidence from weak evidence, identify flaws in experimental designs, and determine what conclusions data actually support. These require scientific judgment AI cannot provide.

Instructional shifts:

- **Increase time critiquing experimental validity.** Students need more practice identifying confounding variables, evaluating whether controls are adequate, and recognizing when designs cannot test their intended hypotheses. Reduce time following prescribed protocols; increase time analyzing whether protocols are sound.
- **Emphasize evidence quality over evidence quantity.** Teach students to evaluate research methodology, recognize limitations in studies, and assess whether claims are warranted by data. Shift from accepting sources at face value to critically examining how evidence was generated.
- **Develop scientific interpretation skills beyond calculation.** Students must learn what statistical results mean in a scientific context—not just whether p-values indicate significance, but whether findings reveal meaningful patterns, how those fit with existing theory, and what uncertainties remain.

Transform: Teach Strategic Investigation with Complex Data

Why this matters: Scientific work increasingly involves managing large, messy datasets and making strategic decisions about data collection, visualization, and analysis. Students must learn to direct these processes while AI handles execution.

Instructional shifts:

- **Enable work with realistic datasets.** Students should encounter messy, real-world data requiring cleaning decisions and interpretation—not just clean textbook datasets. Focus instruction on strategic choices about data integrity, appropriate visualizations, and valid analytical approaches.
- **Assess investigative decision-making.** Evaluate the quality of students' choices throughout investigations: Which variables did they measure and why? How did they refine their approach based on preliminary results? What justified their analytical choices? This develops scientific judgment.
- **Connect to current research.** Students should engage with actual scientific literature, identifying gaps, and designing investigations that extend or challenge existing findings. Reduce time on confirmatory “cookbook” labs; increase time on authentic inquiry.

Streamline: Embed Data Management in Investigation

Why this matters: Data organization, basic visualization, and literature retrieval follow procedures AI executes reliably. These remain necessary but don't warrant standalone instructional time.

Instructional shifts:

- **Embed data management in authentic investigations.** Teach graphing, table-formatting, and database skills just-in-time within research contexts where students immediately see why these tools matter, rather than through standalone units. Students develop these skills through use, learning to organize and visualize data when they need to communicate findings or identify patterns.
- **Automate mechanical tasks.** Data entry, formatting, and basic organization should happen quickly so students can focus cognitive effort on interpretation and experimental design.
- **Embed source location in research work.** Don't teach literature searching as a separate skill. Students should find sources when they need them for actual investigations, with instruction focused on what they do with sources once found.

Anchor: Protect Hands-On Experimental Practice

Why this matters: Physical laboratory work develops understanding of real-world constraints, measurement challenges, and troubleshooting through embodied experience. Students must physically set up apparatus, encounter unexpected results, and adapt procedures in real time. This hands-on practice builds practical judgment about what is feasible and controllable in ways that simulations cannot replicate—the learning happens through tactile engagement with equipment and materials.

Instructional shifts:

- **Require regular hands-on execution and adaptation of experiments.** Students must physically set up apparatus, take measurements, encounter unexpected results, and adapt procedures in real time. This develops practical judgment about what is feasible and controllable in a way simulations cannot.
- **Assess real-time problem-solving.** Push students to troubleshoot equipment issues, respond to anomalous results, and make sound decisions when facing uncertainty in the lab. This builds experimental competence simulations cannot replicate.
- **Emphasize physical measurement and uncertainty.** Students must develop intuition for measurement limitations, sources of error, and why uncertainty exists. The act of taking measurements and judging their reliability requires hands-on experience.

Social Studies

Learning Standard

C3 Framework — D2.His.16.9–12 — Integrate evidence from multiple relevant historical sources and interpretations into a reasoned argument about the past.

(Citation: College, Career, and Civic Life (C3) Framework for Social Studies State Standards, National Council for the Social Studies.)

Best-Matching Learning Objective:

Inquiry-based learning emphasizing questioning, research, analysis of primary and secondary sources, and evidence-based conclusions.

Intermediating skills:

- Analytical writing
- Research design and planning
- Source credibility assessment
- Critical reading
- Evidence evaluation
- Information literacy
- Data collection methods

Additional intermediating skills to consider:

- Citation management and formatting

Quadrant Placement

Skill	Quadrant	Rationale
Analytical writing	<i>Transform</i>	Analytical writing in historical inquiry requires synthesizing multiple sources, constructing interpretive arguments about the past, and explaining historical causation. AI can significantly augment this process by organizing evidence, suggesting thematic connections, and modeling analytical structures, while students direct the historical analysis and make final interpretive judgments.
Research design and planning	<i>Transform</i>	Research design involves formulating historical questions and developing strategies for investigation. AI can significantly augment this by suggesting related topics, identifying relevant time periods and sources, and proposing lines of inquiry, while students evaluate these options and determine which inquiries are most historically significant and feasible.

Skill	Quadrant	Rationale
Source credibility assessment	<i>Deepen</i>	Source credibility assessment requires understanding the motivations, limitations, and perspectives of the source's creator—social and contextual evaluation that deepens with historical knowledge. Students must learn to ask: 'Did this person have a reason to lie? What pressures were they under? What could they not have known?' This contextual judgment develops through repeated practice evaluating sources within their historical moment, building the discernment to recognize when a document's perspective makes it more or less reliable for answering particular questions.
Critical reading	<i>Anchor</i>	Critical reading of historical sources requires sustained engagement with primary documents and the interpretive work of understanding what sources reveal and conceal. This cognitive work—wrestling with contradictory accounts, recognizing bias, making interpretive connections across contexts—develops through direct struggle with challenging historical texts. Students must learn to read against the grain, identify what's absent, and place documents within their historical moment. Summaries and explanations bypass this essential interpretive practice.
Evidence evaluation	<i>Deepen</i>	Evidence evaluation requires contextual judgment about a source's reliability, perspective, and relevance to a specific historical argument—expertise that deepens with practice. While AI can retrieve sources, students must develop judgment about which evidence is most significant and how sources should be weighted in constructing historical arguments.
Information literacy	<i>Streamline</i>	Information literacy in historical research includes procedural knowledge of navigating databases, using search operators, and identifying archives. These structured search tasks can now be executed efficiently through automated tools, allowing students to focus cognitive energy on evaluating and interpreting what they find—the harder, more essential work of historical thinking.
Data collection methods	<i>Transform</i>	Data collection involves identifying and gathering relevant sources. AI can execute searches while students focus on defining parameters, evaluating relevance, and making inclusion decisions, creating a workflow where students direct research strategy rather than manually executing searches.
Citation management and formatting	<i>Streamline</i>	Citation formatting follows standardized rules requiring no interpretive judgment. The mechanical work can be automated with high accuracy, allowing students to focus on intellectual work while learning why and when to cite.

Revised Instructional Approach

Traditional social studies instruction emphasizes writing research papers from scratch, with students spending significant time locating sources, taking notes, and organizing information. Much of this time is devoted to mechanical tasks rather than historical thinking. Because AI now handles source retrieval and the initial organization of information efficiently, instruction must reallocate time toward the core historical thinking skills: research design, source evaluation, and argument construction

Anchor: Protect Foundational Interpretive Practices

Why this matters: Close, critical reading of primary sources is where historical thinking is forged. Students must build interpretive capacity through direct engagement with historical documents.

Instructional shifts:

- **Require regular independent primary source analysis without AI.** Students must practice extracting meaning from historical documents independently: analyzing language, identifying perspective, recognizing what's absent, and placing sources in context.
- **Assess depth of historical engagement.** Evaluate whether students grapple with complexity, recognize nuance, and engage meaningfully with diverse perspectives—not just whether they comprehend basic facts or timelines.

Deepen: Build Historical Judgment

Why this matters: Students must learn to evaluate source credibility in historical context and weigh competing interpretations. These skills require contextual judgment that deepens with practice.

Instructional shifts:

- **Focus on source credibility and evidence evaluation.** Maximize time critically judging sources—considering authorship, purpose, audience, perspective, and limitations in historical context.
- **Develop reasoning about uncertainty.** Students must learn to weigh competing interpretations, recognize when evidence is insufficient, and understand that historical conclusions are provisional.

Transform: Teach Research as Strategic Direction

Why this matters: Students must learn to direct research processes strategically, using AI as a tool for exploration while maintaining responsibility for interpretive decisions.

Instructional shifts:

- **Assess research design and decision-making.** Evaluate students' choices: What questions guided research? How did they refine inquiries? Which sources did they include or exclude, and why?
- **Enable work with larger, more diverse source sets.** Students should encounter complex source bases requiring organization and synthesis, focusing on interpretive decisions about what sources reveal.
- **Teach analytical writing as argument construction.** With AI assisting in organization, instruction focuses on developing clear theses, using evidence strategically, and constructing persuasive arguments about causation and significance.

Streamline: Automate Procedural Tasks

Why this matters: Procedural tasks like citation formatting, database searching, and source location consume time but contribute little to historical thinking. Automating these reclaims time for analysis and interpretation.

Instructional shifts:

- **Embed information retrieval in authentic research.** Students learn to use AI-powered search, database filters, and advanced search operators when they need sources for actual investigations, not through standalone library instruction. The focus shifts from teaching search procedures in isolation to teaching students to define effective parameters and evaluate results within the context of their research questions.
- **Automate citation management.** Teach students to use citation management tools rather than manually formatting citations. The skill becomes using technology efficiently and verifying output for accuracy.
- **Use AI for initial organization of large source sets.** Teach verification practices: checking AI output against originals, identifying omissions, recognizing where interpretation is needed. The goal is efficient organization, not replacement of critical reading.

Computer Science

Learning Standard

CSTA 3B-AP-14 — Construct solutions to problems using student-created components, such as procedures, modules, and/or objects.

(Citation: Computer Science Teachers Association (CSTA) K-12 Computer Science Standards, Algorithms & Programming strand.)

Best-Matching Learning Objective:

Design, develop, and test algorithms and computer programs.

Intermediating skills:

- Computational thinking
- Deductive reasoning
- Logic, formal and informal
- Mathematical problem solving
- Systems thinking
- Troubleshooting

Additional intermediating skills to consider:

- Collaboration and teamwork
- Creativity and innovation
- Metacognition and self-regulation

Quadrant Placement

Skill	Quadrant	Rationale
Computational thinking	<i>Transform</i>	Computational thinking involves breaking down problems into logical steps, recognizing patterns, and designing algorithmic solutions—a process that AI can significantly augment by generating code, suggesting optimizations, and identifying edge cases. This creates a Transform workflow where students focus on high-level problem decomposition and solution design while AI handles implementation details and iterative refinement.
Deductive reasoning	<i>Transform</i>	Deductive reasoning is the constructive process of applying logical principles to design a solution and verify its correctness. This creates a Transform workflow where a student directs the high-level reasoning ("If this input is provided, this path should be taken") while using AI to generate the corresponding code, check for logical inconsistencies in the design, and explore the implications of their choices. The focus is on the forward-looking design of a logical system.

Skill	Quadrant	Rationale
Logic, formal and informal	<i>Streamline</i>	Formal and informal logic skills involve understanding Boolean operations, conditional statements, and logical operators—foundational concepts that students need for programming but can now practice efficiently in applied contexts. Understanding basic logical structures remains important for reading and writing code, but routine logical transformations (syntax checking, logic simplification) can be automated, allowing students to focus on higher-order problem-solving where they must choose which logical structures to use and why.
Mathematical problem solving	<i>Anchor</i>	Mathematical problem solving in computer science requires translating problems into computational form, selecting appropriate algorithms, and evaluating solution complexity—skills that must be developed through direct practice with increasingly challenging problems. While AI can suggest algorithms, students must build the deep understanding needed to determine which approaches fit different problem types and constraints. This foundational capacity cannot be outsourced.
Systems thinking	<i>Transform</i>	Systems thinking involves understanding how components interact, managing dependencies, and predicting emergent behaviors—a process that AI can augment by mapping relationships, identifying bottlenecks, and simulating system behaviors. This creates a Transform workflow where students make architectural decisions about system design while AI helps visualize interactions and evaluate design trade-offs.
Troubleshooting	<i>Anchor</i>	Troubleshooting is the diagnostic process of applying deductive reasoning to a system that has failed. It requires forming hypotheses about errors, isolating variables, and systematically testing to find the root cause. This process of grappling with unexpected failure builds deep diagnostic intuition—students develop mental models of how systems work by experiencing how they break. This learning happens through the investigation itself: forming hypotheses, testing them, revising understanding when tests produce unexpected results. Merely executing suggested fixes bypasses this essential cognitive work.
Collaboration and teamwork	<i>Transform</i>	Collaboration and teamwork in programming involves coordinating with others on shared codebases, conducting code reviews, and integrating contributions—processes that AI can augment through version control assistance, merge conflict resolution, and automated documentation. Students focus on communication, coordination, and collective decision-making while AI handles routine collaboration mechanics.

Skill	Quadrant	Rationale
Creativity and innovation	<i>Deepen</i>	Creativity and innovation in programming requires generating novel solutions, combining existing techniques in new ways, and designing elegant approaches to complex problems—skills that deepen with practice and exposure to diverse problems. While AI can suggest standard approaches, it cannot replicate the creative insight needed to develop truly innovative solutions or recognize when unconventional approaches might work better.
Metacognition and self-regulation	<i>Anchor</i>	Metacognition and self-regulation involve monitoring one's own understanding, recognizing when stuck, selecting appropriate debugging strategies, and managing the learning process—skills that develop through authentic problem-solving contexts where students must make these decisions themselves. Students must practice recognizing their own confusion, deciding what to try next, and evaluating whether an approach is working. This self-awareness and regulatory capacity emerge through repeated experience directing their own learning, not through receiving external direction about what to do next.

Revised Instructional Approach

Traditional computer science instruction emphasizes individual code production, with students spending significant time writing programs from scratch, memorizing syntax, and fixing errors. Because AI now generates syntactically correct code reliably, instruction must reallocate time toward architectural thinking, systematic debugging, and creative problem-solving—skills that require deep understanding and strategic judgment.

Anchor: Protect Problem-Solving Foundations and Diagnostic Thinking

Why this matters: Mathematical problem-solving, systematic troubleshooting, and metacognitive self-regulation develop only through direct engagement with challenging problems. These foundational capacities cannot be built by watching AI solve problems.

Instructional shifts:

- **Require regular debugging without AI assistance.** Students must practice diagnosing errors systematically—forming hypotheses, testing them, and verifying fixes. This builds the diagnostic reasoning that underlies all programming work. The learning happens through the investigation process itself: experiencing the satisfaction when a hypothesis proves correct, the frustration when it doesn't, and the growing intuition about where bugs hide. This diagnostic capacity develops through practice, not through receiving solutions.

- **Emphasize mathematical reasoning before implementation.** Students should solve problems mathematically first—working through examples by hand, identifying patterns, describing algorithms in plain language—before translating to code. This builds foundational understanding of computational processes.
- **Develop metacognitive awareness.** Students must learn to monitor their own understanding, recognize when they're genuinely learning versus copying, and regulate their use of AI tools. Regular reflection on learning processes builds this self-awareness.

Transform: Teach Architectural Thinking and System Design

Why this matters: Software development increasingly involves designing systems, coordinating components, and making strategic decisions about architecture. Students must learn to direct these processes while AI handles implementation details.

Instructional shifts:

- **Shift focus from coding to architecture.** Teach students to design system structure, component interfaces, and data flow before implementation. Assess the quality of their architectural decisions, not just whether code runs.
- **Emphasize critical evaluation of generated code.** Students must learn to review generated code—understanding what it does, why it works (or doesn't), and how to integrate it effectively into larger systems. Develop capacity to be critical consumers of AI output.
- **Build systems thinking capacity.** Students should work with complex multi-component projects where the challenge is coordination and integration, not individual pieces. This develops understanding of how components interact and emergent system behaviors.
- **Teach collaborative development practices.** Real software development involves coordination with others and shared codebases. Students need practice with code reviews, version control, and collective refinement of solutions in AI-augmented environments.

Streamline: Embed Syntax and Logic in Problem-Solving

Why this matters: Syntax checking, logic simplification, and formal transformations follow rules AI applies reliably. These don't warrant standalone instructional time when they can be automated.

Instructional shifts:

- **Embed syntax learning in authentic programming contexts.** Reduce time drilling syntax rules or debugging syntax errors in isolation—modern development environments catch these automatically. Students learn syntax through use in meaningful programs, with just-in-time instruction when specific constructs are needed. Focus class time on problem decomposition and solution design.
- **Automate logic verification.** Use AI tools to simplify Boolean expressions, check logical consistency, and verify formal correctness. Redirect time toward understanding when and why to use different logical structures.
- **Enable rapid iteration.** AI's ability to generate working prototypes quickly allows students to test ideas, refine designs, and iterate—spending less time on the mechanics of implementation and more on design improvement.

Deepen: Build Creative and Innovative Solution Strategies

Why this matters: Generating novel approaches, recognizing when unconventional solutions work better, and developing elegant code require creative insight AI cannot replicate. These distinguish competent from exceptional programmers.

Instructional shifts:

- **Preserve creative problem-solving practice.** Novel problems without standard solutions develop creative insight and the capacity to combine techniques in new ways. Students must practice generating original approaches, not just implementing known algorithms.
- **Present problems without standard solutions.** Students need practice with novel challenges where they must creatively combine concepts or develop new approaches. This builds innovative thinking beyond implementing known algorithms.
- **Teach multi-dimensional solution evaluation.** Students should learn to assess solutions on creativity, efficiency, elegance, and readability—not just correctness. This develops aesthetic judgment about code quality.
- **Emphasize optimization and refactoring.** Give students working code and challenge them to improve it through creative redesign. This builds capacity to recognize better solutions and implement them elegantly.

Cross-Subject Themes:

Mapping Key Patterns of AI Disruption

While an analysis tailored to specific learning contexts will provide the most refined and comprehensive path forward, this initial analysis reveals several cross-subject, macro-level insights. These patterns are not prescriptive rules but strategic guideposts, suggesting where to focus initial conversations and experiments to achieve the greatest impact.

Two Lenses for Strategizing Change

Not all skills are represented equally across the curriculum. By cross-referencing the frequency with which each skill appears in the 140 learning objectives with the skill's AI impact classification, we can identify the primary epicenters of disruption. The distribution is revealing:

- **Transform (34% of appearances):** Workflows that AI now handles collaboratively (e.g., research, data analysis, writing).
- **Anchor (30%):** Core human abilities that require authentic performance (e.g., critical reading, problem-solving, ethical reasoning).
- **Deepen (19%):** Skills where AI augments human judgment and performance (e.g., oral communication, creativity and innovation).
- **Streamline (17%):** Procedural tasks that AI can automate, freeing up cognitive resources (e.g., grammar/syntax).

The key insight is that the **Transform** and **Anchor** quadrants dominate, accounting for nearly two-thirds (64%) of all skills identified in the curriculum. This suggests that any initial strategy will yield the greatest return by focusing on these two fundamental shifts: redesigning collaborative workflows with AI and, simultaneously, reinforcing uniquely human skills.

Four Keystone Skills at the Heart of the Curriculum

Drilling down further, four skills appear with such high frequency that they function as a “keystone” for the entire curriculum. Their distinct interactions with AI map out the central challenges and opportunities ahead.

- **Critical reading (36 appearances, Anchor).** Whether analyzing historical documents, scientific papers, or literary texts, the ability to read closely, question assumptions, and synthesize meaning remains resistant to automation. The low automation/augmentation scores (0.38/0.24) confirm what educators know intuitively: comprehension is still a profoundly human endeavor.

- **Intercultural competence and global awareness (36 appearances, Deepen).** Its prevalence reflects both the reality of globalization and the aspirations of modern education. With high augmentation potential (0.34/0.71), this skill benefits substantially from AI tools—like real-time translation and cultural databases—while the core of the skill—empathy, perspective-taking, and genuine understanding—remains fundamentally human.
- **Systems thinking (34 appearances, Transform).** From ecology to economics, students must learn to see relationships, feedback loops, and unintended consequences. AI is transforming this work, handling much of the complex modeling (automation/augmentation scores of 0.53/0.82). The human role, however, becomes more critical: it is human judgment that determines which systems to model, what variables to include, and how to interpret the results.
- **Information literacy (32 appearances, Streamline).** The high frequency of this skill, paired with its high automation score (0.73/0.37), reveals an evolution in progress. AI now handles many of the mechanics we traditionally taught—finding sources, organizing research, managing citations. This suggests a strategic pivot: rather than reducing instruction in information literacy, we should elevate it. The focus must shift from the mechanics of finding information to the higher-order judgment required to use it, folding instruction directly into skills like **source credibility assessment (22 appearances, Deepen)** and **evidence evaluation (31 appearances, Deepen)**.

Three Other High-Impact Skills

Beyond the top four, three other skills appear frequently enough to signal clear curricular priorities and distinct patterns of AI impact.

- **Written Communication (30 appearances, Transform).** Spanning every subject, its presence confirms that “writing across the curriculum” is standard practice. However, AI’s transformation of writing workflows demands a pedagogical shift: away from assessing drafting mechanics and toward cultivating rhetorical purpose, audience awareness, and sophisticated revision.
- **Active Listening & Dialogue (30 appearances, Anchor).** The frequent appearance of this skill across ELA, science, and social studies signals a deep pedagogical commitment to discussion-based learning. AI paradoxically strengthens this commitment. As information retrieval becomes trivial, the classroom’s value shifts toward these uniquely human interactions that build community and deepen understanding.

- **Evidence Evaluation (31 appearances, Deepen).** Appearing nearly as often as critical reading itself, and concentrated in science and social studies, this skill reflects a clear curricular response to the modern challenges of misinformation. It represents a crucial area where human discernment is augmented, not replaced, by technology.

Focusing on these high-frequency quadrants and keystone skills provides a powerful starting point for educators to begin experimenting with curricular redesign.

Of course, scaling this work more comprehensively requires dedicated time, collaborative structures, and often external partnership. The section that follows outlines what systemic implementation demands.

How Assessment Must Change

When skills shift quadrants, assessment must follow. Traditional assessments often measure what students can now do easily with the support of AI tools—producing text, solving equations, and retrieving information. Assessment under this framework focuses on what remains distinctly human: judgment, reasoning, and adaptive thinking.

Deepen: Assess conceptual understanding, not procedural execution. Can the student explain why a method works? Can they adapt it to unfamiliar contexts or identify when it doesn't apply?

Transform: Assess the process, not just the product. How did the student evaluate their options? What criteria drove their revision choices? Grade the reasoning trail, not just the final artifact.

Streamline: Don't assess these skills in isolation. Evaluating command of grammar or procedural fluency should surface within larger performance tasks, not as standalone tests.

Anchor: Assess through authentic performance, such as oral defense, live deliberation, real-time problem-solving, or physical demonstration. These skills require presence and cannot be easily delegated to technological tools.

General principles:

- Assess the reasoning process: How did students frame the problem? What criteria guided their choices? How did they evaluate whether their solution makes sense?
- Favor process documentation: reasoning logs, revision histories, decision justifications
- Use AI-generated artifacts as assessment stimuli—ask students to critique, improve, or verify
- Reserve high-stakes assessment for skills that require human judgment.

SECTION V:

Implications for Policy and Practice

This report provides a framework for understanding how AI reshapes foundational skills—the intermediating competencies that connect classroom learning to workplace performance. But the implications extend beyond workforce preparation. How schools teach these skills will determine whether students graduate ready to collaborate effectively with AI—or are left unprepared for the tools reshaping their fields.

Understanding the framework is not the same as implementing it. Section IV demonstrated how this analytical approach can be applied to core learning standards—identifying intermediating skills, mapping their AI exposure, and redesigning instruction accordingly. But the examples also reveal the complexity: this work requires collaborative analysis, domain expertise, and sustained effort. A framework is a lens for seeing clearly, not a blueprint for moving quickly.

What makes implementation challenging is not conceptual—the four quadrants are straightforward. The challenge is operational: determining which intermediating skills underlie your specific standards, evaluating their automation and augmentation potential in your local context, building consensus about instructional priorities, and redesigning curriculum while managing the inevitable constraints of time, resources, and institutional inertia. The policy recommendations that follow focus not on what to think, but on creating the conditions that enable thoughtful action.

This implementation challenge is especially acute for Career and Technical Education (CTE). Many of the career fields CTE feeds—healthcare, manufacturing, IT, business services—are changing fastest, and these disruptions are already underway. The framework in this report applies directly: identify the intermediating skills in each CTE standard, map them to quadrants, and redesign instruction accordingly. Workforce preparation and AI readiness aren’t competing aims. They are the same agenda.

What follows are two fundamental shifts in how schools can approach curriculum and assessment, followed by three enabling conditions required to make those shifts possible.

Two Fundamental Shifts

1. Redefine skill prioritization based on automation and augmentation potential.

Each quadrant suggests different instructional emphasis:

- **Deepen (Low Automation/High Augmentation):** These skills require greater conceptual mastery, not more practice. Investment shifts from breadth of execution to depth of reasoning about principles, so students can direct AI augmentation effectively.
- **Transform (High Automation/High Augmentation):** These skills demand the most sophisticated pedagogical redesign. Students must learn to direct AI, evaluate output, and verify quality—which requires deeper conceptual understanding than solo execution ever did.
- **Streamline (High Automation/Low Augmentation):** These skills develop efficiently when integrated into authentic contexts rather than isolated drills. Students build fluency through application within Deepen and Transform work, where automation handles routine execution while students focus on applying these foundations purposefully.
- **Anchor (Low Automation/Low Augmentation):** These irreducibly human skills require protected time and authentic practice. They develop through doing, not through worksheets or simulations. Protect them from pressure to automate, accelerate, or measure cheaply.

These aren't incremental adjustments. They require explicit conversations about what to de-emphasize, what to elevate, and what to fundamentally reimagine. State standards, district curricula, and course syllabi should reflect these choices transparently.

2. Redesign assessment to measure judgment, not execution.

Current standardized tests measure precisely what AI does best: recall, computation, pattern matching. New assessments must evaluate the thinking behind the work. How did students frame the problem? What tradeoffs did they recognize? How did they verify results? What was their reasoning for accepting or rejecting AI suggestions? When did they choose not to use AI, and why? What domain knowledge did they bring that shaped how they directed or evaluated AI outputs?

For Transform skills, process artifacts (plans, prompts, revision rationales) become the primary evidence of learning. For Deepen and Anchor skills, performance rubrics must emphasize reasoning and ownership. For Streamline skills, assessment should be embedded in the domains through which these skills are expressed: can students recognize when precision matters, evaluate AI-generated outputs for correctness, and apply these foundations strategically in context?

This shift will disrupt current testing systems, but it's unavoidable. The Assessment Principles in Section IV outline what this looks like for each quadrant—from process documentation for Transform skills to authentic performance for Anchor skills. Schools should begin piloting now: portfolio-based assessment, design challenges, and performance tasks that capture judgment rather than polish.

Three Enabling Conditions

1. Support educators as learning designers, not tool trainers.

Teachers need more than workshops on AI platforms. They need time to reimagine curriculum, space to experiment, and intellectual partnership with colleagues. Professional development should focus on pedagogical frameworks—the quadrant model, judgment-ready mastery, workflow evidence—rather than specific technologies, which evolve rapidly. Concretely, this means:

- **Quadrant mapping:** Teachers analyze their learning standards by identifying intermediating skills, evaluating those skills for automation and augmentation potential, and determining which quadrants their courses occupy. The goal is to ensure instructional priorities reflect how AI is reshaping skill development: where automation reduces the need for manual execution, where augmentation reshapes workflow, and where human judgment remains essential.
- **Design labs:** Small teams of teachers engage in low-stakes spaces where they can experiment with quadrant-aligned instruction. Teachers co-create, test, and refine new task designs; explore how AI reshapes student workflows; and prototype revised pedagogical approaches. These collaborative spaces surface promising practices and build shared models of AI-ready teaching.
- **Curriculum coaching:** Districts provide coaches who understand the framework and help teachers operationalize it within their subject and grade level.
- **Cross-school learning networks:** Teachers visit other schools piloting the framework and participate in regular knowledge-sharing sessions. These networks normalize new practices and accelerate diffusion of what works.

While the framework provides important diagnostic guidance, educators will need ongoing support in evaluating how each learning objective maps to the quadrants and reshaping instructional approaches correspondingly. That capacity to ask questions and to make evidence-based decisions matters far more than familiarity with any particular tool. Organizations like aiEDU offer professional development aligned with this framework, helping educators build that capacity.

2. Create structures for rapid prototyping and scaling.

Innovation won't happen in isolation. Implementing quadrant-aligned instruction at scale requires structures that allow schools to prototype, refine, and expand new models. States could designate networks of lab schools, public charters, and district pilots committed to AI-integrated instruction with explicit research partnerships. These sites would operate with some regulatory flexibility in exchange for rigorous documentation and regular knowledge-sharing. Rather than every district reinventing the wheel, these networks become rapid-iteration hubs that identify and spread what works.

Cross-sector partnerships amplify this work. Schools partnering with universities, health systems, tech companies, and other employers can co-design curricula around real human-AI collaboration, surfacing the human skills that remain essential and determining how to teach them authentically. These partnerships ground the framework in actual workplace contexts, ensuring that the skills emphasized in school align with how professionals actually work.

3. Close the opportunity gap.

Students in under-resourced schools face a double bind: they're most likely to be educated for automatable work and least likely to have access to AI tools or expert teachers. This isn't a separate concern. It's central to whether this framework succeeds at all. If students in wealthy districts learn to direct AI while students in under-resourced districts practice skills AI can do, this work will have exacerbated existing divides.

Every policy decision—from curriculum emphasis to tool access to teacher investment—must be made with this problem in mind. Specifically, schools and districts should:

- **Prioritize teacher recruitment and retention in under-resourced schools**, offering competitive compensation and sustained professional development rather than one-off trainings.
- **Ensure equitable access to AI tools and technology** for experimentation—not as a luxury for privileged schools, but as infrastructure for all students.
- **Audit curriculum choices** to ensure students in under-resourced schools aren't left unprepared for meaningful careers by outdated instruction while peers in affluent schools are readied for human-centered work.
- **Build partnerships with community organizations, employers, and higher education** to create authentic learning contexts—especially for Anchor skills, which develop through real-world practice rather than classroom simulations.

Expand the Frame: Beyond Workforce Preparation

This analysis is grounded in workforce data—which skills matter for professional success and economic mobility. But workplace demand is only one lens: skills that support personal fulfillment and civic life also matter. Some of these—ethical reasoning, creative expression, leadership—are essential to a healthy democracy, not just workplace success. These should remain central to K-12 education regardless of workforce trends.

Moreover, our research suggests that AI may reshape how many of these skills are used. How AI reshapes these capacities is beyond the scope of this report, but the question deserves equally rigorous attention from researchers, educators, and policymakers. Schools should not allow workforce readiness to crowd out the deeper question: what does it mean to educate young people for a purposeful life and active citizenship in the age of AI?

CONCLUSION:

From Framework to Action

The question isn't whether AI will reshape the skills students need—it will. Students who entered high school this fall will graduate into workplaces where human-AI collaboration is the norm. The question is whether educators have the framework and support to lead this transformation deliberately in the years before those students graduate, and beyond.

This report provides educators with a data-driven framework for making deliberate choices about what to teach. The patterns challenge comfortable assumptions, but they also create clarity. The harder work—translating that framework into classroom practice—requires the enabling conditions outlined in Section V: time for collaborative analysis, structures for experimentation, and support for pedagogical redesign.

For individual educators ready to begin, the path forward starts with one intermediating skill. Evaluate its automation and augmentation potential to determine which quadrant it occupies. Ask: What do the corresponding principles suggest about how students develop it? Experiment with one instructional shift. Notice what changes. Then expand.

Over time, this framework can stop being a reference tool and become a pattern of thinking—a lens for asking why certain structures work for certain skills, rather than defaulting to what's always been done.

AI is already reshaping how professionals work across industries. Whether schools prepare students for this reality will depend on whether educators have the support they need to make deliberate choices about curriculum and instruction. By making explicit choices about what capabilities to develop, how to teach them, how to prioritize scarce instructional time, and where human judgment remains irreplaceable, educators can prepare young people not just to adapt to an AI-shaped future, but to thrive in it.

Appendix

List of Intermediating Skills

The 49 intermediating skills identified in this analysis:

Abductive reasoning	Active listening and dialogue	Algebraic fluency	Analytical writing
Argument construction	Causal inference	Civic literacy and civic participation	Collaboration and teamwork
Computational thinking	Creativity and innovation	Critical reading	Data cleaning and preparation
Data collection methods	Data visualization	Deductive reasoning	Digital citizenship and cybersecurity hygiene
Economic thinking	Estimation and approximation	Ethical reasoning	Evidence evaluation
Experimental design	Financial literacy	Functional and graphical thinking	Geometric reasoning
Grammar and syntax	Inductive reasoning	Information literacy	Intercultural competence and global awareness
Interdisciplinary thinking	Logic formal and informal	Mathematical problem solving	Measurement and uncertainty analysis
Media literacy	Metacognition and self-regulation	Oral communication	Presentation design and delivery
Probabilistic thinking	Proportional reasoning and scaling	Quantitative modeling	Research design and planning
Rhetorical reasoning	Scientific modeling	Source credibility assessment	Spatial reasoning
Statistical reasoning	Systems thinking	Troubleshooting	Vocabulary usage
Written communication			

List of Learning Objectives

The 140 core learning objectives synthesized from state standards:

Achieve linguistic accuracy, appropriate vocabulary usage, and fluency in the target language.	Acquire and use academic and technical vocabulary effectively across contexts.	Adapt writing for different contexts, audiences, purposes, and formats.
Address global and social justice issues through multilingual and multicultural engagement.	Analyze and interpret data to derive meaningful conclusions.	Analyze and troubleshoot basic computing hardware and software issues.
Analyze cause and effect relationships to understand mechanisms driving phenomena.	Analyze structure, craft, and author's purpose, understanding their impact on meaning and effectiveness.	Analyze the impact of computing and technology on society, economy, and culture.
Apply computational knowledge to evaluate potential opportunities and risks presented by emerging technologies.	Apply critical thinking and reasoning to solve mathematical and real-world problems.	Apply fundamental principles of physics, mathematics, and engineering in practical contexts.
Apply language skills to real-world and spontaneous contexts.	Apply mathematics to personal finance, economic decision-making, and workplace scenarios.	Apply scientific knowledge and technologies to address real-world challenges effectively.
Appreciation and understanding of constitutional republic and representative democracy	Appreciation of cultural diversity and recognition of contributions from different ethnic, religious, and cultural groups.	Ask testable questions and define problems clearly and precisely.
Awareness of government structures at local, state, and federal levels, and their interrelationships.	Awareness of individual and collective identities, interactions within communities, and factors influencing social dynamics.	Awareness of social justice issues, equity, and the historical struggle against prejudice, discrimination, and racism.
Basic understanding of economic concepts: scarcity, choice, supply and demand, production, consumption, distribution, specialization, and market structures.	Chronological thinking, interpretation, comprehension, and historical research.	Clearly and effectively communicate scientific ideas, data, and arguments through multiple formats (written, oral, graphical, computational).
Clearly communicate mathematical ideas and solutions orally, visually, and in writing using precise mathematical language and multiple representations (graphs, tables, symbols, diagrams).	Clearly present ideas in formal and informal contexts, adapting content, voice, tone, and style appropriately.	Collaborate effectively in teams, engaging in scientific practices to investigate and solve problems.

Collect, interpret, and analyze data to make informed decisions and predictions.	Collect, organize, interpret, and analyze data using computational methods.	Comprehend and analyze complex literary and informational texts.
Conduct and present research, integrating credible and relevant sources, evaluating source reliability and validity.	Conduct scientific inquiry and apply critical thinking and reasoning.	Conduct thorough research and inquiries, integrating and synthesizing information from multiple credible sources.
Create computational artifacts using appropriate programming languages and tools.	Critical evaluation of sources, distinguishing fact from opinion, and awareness of biases.	Critical thinking, problem-solving, and decision-making abilities.
Critically evaluate information sources, including digital and media resources, for credibility and accuracy.	Critically evaluate scientific arguments and explanations provided by others.	Critically respond to texts through deep reading, inference making, prediction, and connection.
Cultivate mathematical knowledge relevant to practical life skills and civic engagement.	Demonstrate command of language conventions (syntax, grammar, semantics) across various contexts and formats.	Demonstrate competence in scientific methodologies and laboratory practices.
Demonstrate effective communication across the three modes: Interpretive Mode (listening, reading, viewing), Interpersonal Mode (interactive speaking and writing), Presentational Mode (spoken and written production for various audiences)	Demonstrate innovative design skills and creative application of computing technologies.	Demonstrate proficiency in Earth and Space Sciences (Earth systems, weather/climate patterns, astronomy, geology).
Demonstrate proficiency in spatial and sequential communication structures specific to American Sign Language.	Demonstrate responsible digital citizenship, safe practices, and cybersecurity awareness.	Demonstrate the ability to analyze, justify, and evaluate mathematical arguments.
Demonstrate understanding and appreciation of cultural practices, products, and perspectives of target cultures.	Demonstrate understanding of network operations, structures, and the internet.	Design, develop, and test algorithms and computer programs.
Determine central ideas, themes, and main arguments of diverse texts, summarizing objectively.	Develop a deep understanding of mathematical concepts alongside proficiency in procedural skills.	Develop coherent and clear texts appropriate for various purposes, including: Argumentative and persuasive writing; Informative and explanatory writing; Narrative and creative writing.
Develop confidence, persistence, and flexibility in mathematical thinking and problem-solving.	Develop global awareness and competence, enabling effective participation in local, national, and international communities.	Develop proficiency appropriate for classical languages focusing primarily on interpretive communication.

Develop proficiency in computational thinking and algorithmic reasoning.	Develop proficiency with different number systems, including rational, irrational, and real numbers.	Develop readiness for post-secondary mathematics and quantitative reasoning requirements.
Develop sustained reading stamina through regular independent reading practices.	Develop, use, and evaluate scientific models (conceptual, physical, mathematical, computational).	Development of informed perspectives through analysis of media and communication.
Development of intellectual curiosity, analytical reasoning, and reflective thought.	Employ technological tools effectively for language acquisition and communication in authentic contexts.	Engage actively with communities at local and global levels using target languages.
Engage effectively in digital collaboration and communication.	Engage effectively in discussions, using active listening, collaboration techniques, and critical reasoning.	Engage in meaningful conversations and exchanges of information, opinions, and feelings.
Enhance critical thinking, problem-solving, creativity, collaboration, and emotional intelligence through language study.	Ensure mathematical competencies align with skills required for college, careers, and informed citizenship.	Ethically and effectively use technology and digital media to gather, interpret, analyze, and communicate information.
Evaluate cybersecurity risks and demonstrate knowledge of strategies to mitigate these risks.	Evaluate ethical considerations and implications of technological innovations.	Evaluate how living organisms (including humans) influence and alter their environments.
Evaluate information from diverse sources (journals, media, web) to make informed decisions.	Exhibit fluency in arithmetic operations (addition, subtraction, multiplication, division), algebraic manipulation, and the use of numerical and algebraic expressions.	Explain how energy and matter flow within and between systems, including ecosystems and physical processes.
Explore, understand, and analyze emerging technologies such as artificial intelligence, robotics, quantum computing, and augmented reality.	Foster a positive attitude toward mathematics, recognizing its value and relevance.	Gain foundational knowledge and skills required for advanced mathematics courses, including Calculus and Advanced Placement (AP) Probability and Statistics.
Gain proficiency in programming concepts and techniques.	Geographic reasoning skills, including map reading and spatial awareness.	Grasp foundational Life Sciences concepts (structure/function of organisms, genetics, biological evolution, ecosystems).

Historical awareness of state-specific, national, and global history, including major events and eras such as colonization, independence, civil war, world wars, and significant movements like the Holocaust and civil rights.	Identify, describe, and apply patterns observed in natural/human-made systems.	In-depth knowledge of the U.S. free enterprise system, capitalism, and global economic interactions.
Independently select and engage with grade-level or higher complexity texts.	Inquiry-based learning emphasizing questioning, research, analysis of primary and secondary sources, and evidence-based conclusions.	Integrate disciplinary literacy (scientific reading, writing, mathematical, and computational skills) in scientific exploration and problem-solving.
Interact respectfully and effectively in intercultural settings.	Interpret and create culturally authentic media and digital content.	Introduction to sociology, anthropology, and psychology to better understand societal and individual behaviors.
Investigate and predict stability and change in systems, explaining static and dynamic conditions.	Knowledge of the U.S. Constitution, Declaration of Independence, and foundational democratic principles.	Make connections between language learning and other academic disciplines (e.g., history, social studies, literature, science, art, technology).
Master foundational literacy skills (phonics, phonemic awareness, vocabulary, fluency, comprehension).	Master handwriting and writing conventions, including legibility and appropriate formatting.	Master linear, quadratic, exponential, polynomial, and radical functions.
Perform transformations and analyze function behaviors graphically and algebraically.	Personal financial literacy, including budgeting, saving, investing, credit management, and responsible financial decision-making.	Plan and carry out scientific investigations (descriptive, comparative, experimental).
Prepare students mathematically to engage effectively in a global workforce.	Promote lifelong learning of languages and cultures to engage successfully as global citizens.	Recognition and understanding of civil rights movements and historical efforts for equality.
Recognition of continuity and change, and the impact of conflict and cooperation in history.	Recognition of geographical influences on cultures, societies, and economic activities.	Recognize and reflect upon cultural differences and similarities between one's own culture and target cultures.
Recognize ethical considerations and societal impacts when applying science and technology.	Recognize ethical, legal, and social implications of technology use.	Recognize, analyze, and solve complex computational problems effectively.

Select and employ appropriate mathematical tools and technologies to support problem-solving and exploration.	Skills for respectful dialogue, fairness, justice, empathy, and conflict resolution.	Solve equations and inequalities, including systems of linear and nonlinear equations.
Strategically adapt language for diverse purposes, audiences, and cultural contexts.	Understand and apply geometric concepts, properties, theorems, and measurement to solve problems.	Understand and apply language structures (syntax, grammar, vocabulary) effectively
Understand and apply principles of probability and statistical reasoning in diverse contexts.	Understand and describe hardware and software components of computing systems.	Understand and responsibly engage with digital tools, including awareness of AI and its ethical implications.
Understand concepts of scale, proportion, and quantity in evaluating phenomena across various contexts.	Understand fundamental concepts in Physical Sciences (matter, forces and motion, energy, waves).	Understand number relationships and operations, including working with exponents, radicals, and logarithms.
Understand personal health, safety, and emotional well-being associated with technology use.	Understand the interactions between human activity and natural environments, including the implications of climate change.	Understand, analyze, and apply systems and system models, including interactions, inputs/ outputs, and behaviors.
Understanding civic responsibilities, democratic participation, and engagement.	Understanding diverse cultural contributions and histories, including marginalized groups and minorities.	Understanding global interdependence and cross-cultural connections.
Understanding interactions between humans and the environment, including resource management, stewardship, and sustainability.	Use digital tools effectively to support learning and productivity.	Use effective verbal and non-verbal communication skills to enhance presentations and discussions.
Use evidence to construct explanations and arguments for natural phenomena.	Use mathematics to model real-world situations, interpret solutions contextually, and evaluate outcomes.	Use spatial reasoning and geometric modeling to interpret and analyze two-dimensional and three-dimensional figures.
Utilize appropriate conventions (grammar, punctuation, spelling, vocabulary) and effective rhetorical strategies.	Utilize culturally authentic resources to enhance understanding of global perspectives.	Utilize data to make informed decisions, solve problems, and create visualizations.
Utilize engineering principles to design, test, and refine solutions to problems.	Value language learning as a means to advance personal, educational, and professional success.	

