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Wired and Unprepared

A Regional Meta-Analysis of K-12 Technology Integration in the Northern Great Plains and Mountain West

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What This Paper Is. What It Is Not.

This paper is:

- A regional meta-analysis applying the six-variable Readiness Stack analytical framework (described in Section II) to seven Northern Great Plains and Mountain West states: Colorado, Minnesota, Montana, Nebraska, North Dakota, South Dakota, and Wyoming.
- Documentation of a regional amplification pattern in which the six national variables compound with greater severity in low-density, resource-thin, and Tribal land communities.
- An introduction of the Dependency Paradox as a seventh compounding variable: the documented risk that unstructured AI access without instructional scaffolding produces AI-dependent rather than AI-literate graduates.
- The second paper in a three-part OCF Education and Workforce Readiness Series, with Paper III narrowing further to South Dakota.

This paper is not:

- A regional repetition of national findings. Regional results modify, extend, and in some cases diverge from national patterns. Those divergences are documented where they occur.
- A complete state-by-state report for any individual state in the region. That granularity is reserved for Paper III. This paper treats the seven-state corridor as a unit of analysis.
- A technology policy position paper. The analysis documents conditions. Whether unstructured AI use is better or worse than no AI use is a contested empirical question this paper reports without prescribing.
- A critique of individual teachers, administrators, or districts. The consistent finding in the literature is that integration failure reflects system-level deficits, not personnel failure.

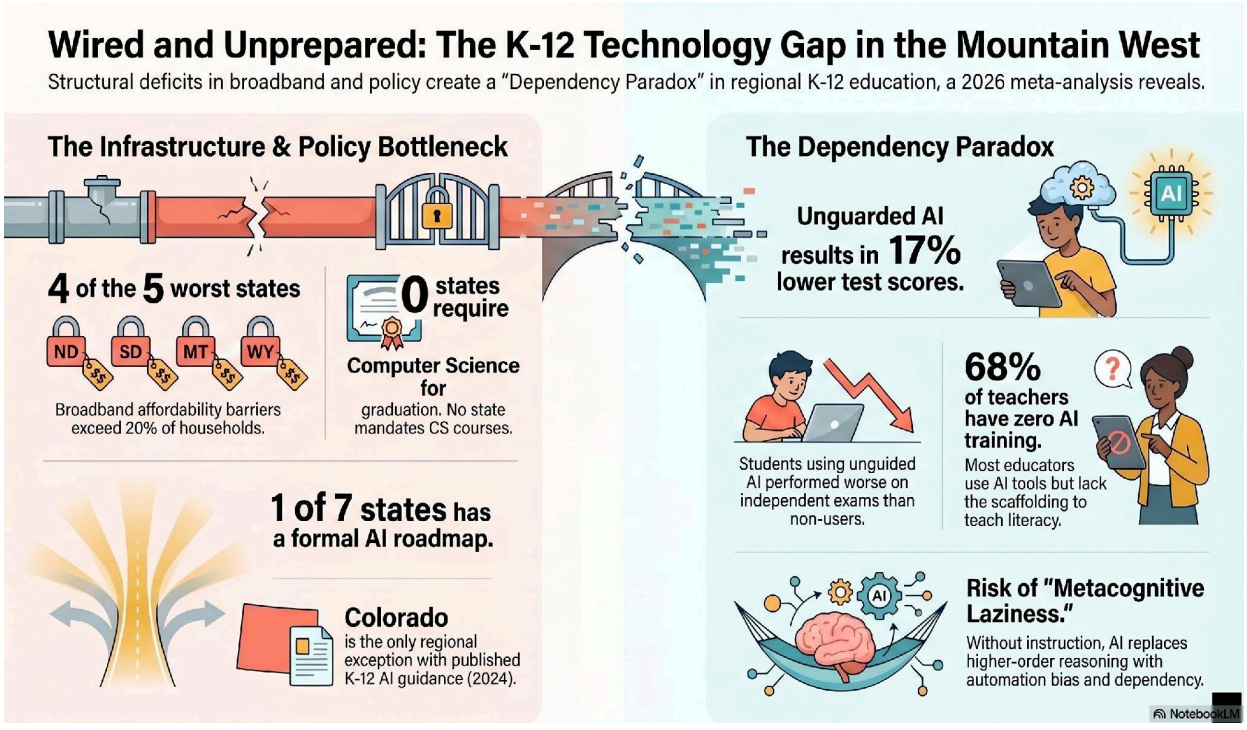

Figure 1. Wired and Unprepared: The K-12 Technology Gap in the Mountain West. OCF / NotebookLM, 2026

Abstract

This paper presents a regional meta-analysis of K-12 educational technology readiness across seven Northern Great Plains and Mountain West states: Colorado, Minnesota, Montana, Nebraska, North Dakota, South Dakota, and Wyoming. This analysis applies the six-variable **Readiness Stack** framework to a region characterized by sparse population density, extensive Tribal land populations, and structural resource constraints that amplify each national variable. The central finding of this paper extends rather than replicates the national finding. The corridor does not merely share the national K-12 preparation deficit. It adds a seventh variable absent from the national analysis: the **Dependency Paradox**. Where AI tools have arrived in regional classrooms, they have arrived without instructional scaffolding, policy frameworks, or teacher training adequate to convert access into literacy. Emerging randomized evidence documents that unstructured AI use in K-12 settings produces no long-term learning gains and may reduce performance on assessments conducted without AI support. In a region where AI guidance is absent in four of seven states and where teacher training infrastructure is among the thinnest in the country, the arrival of AI tools is as likely to deepen the preparation gap as to close it. Five of the seven states in this analysis rank among the worst nationally for broadband affordability. Colorado is the regional exception: the only state in the corridor with a published AI Roadmap, a K-12 Skills Progression Guide, and a coherent integration framework. Its presence in this analysis serves as a documented comparison case. The preparation trajectories of students in Colorado and students in adjacent Wyoming or Montana are diverging. The variable is not student capacity. It is policy architecture.

Keywords: K-12 education, technology integration, AI literacy, Northern Great Plains, Mountain West, Dependency Paradox, structured AI use, rural education, Tribal land education, broadband affordability, policy fragmentation, Readiness Stack, ocf_schema_v1

At a Glance

5 of 7 States ranking among the worst nationally for broadband affordability. ND, SD, MT, WY, and NE face cost barriers exceeding 20% of households.	**1 of 7** State in the region with a published AI Roadmap and Skills Progression Guide. Colorado is the regional exception. Six states have no formal guidance.	**20%** North Dakota's 2024-25 chronic absenteeism rate, below the national average of ~22%. Pre-pandemic, ND held the lowest national rate (9.6% in 2015-16), a relative advantage that persists but has narrowed significantly.	**43%** Chronic absenteeism among low-income students in Nebraska at the 2021-22 peak, up from 26% pre-pandemic. Black students remain at 43% in 2024-25.
0 States in the seven-state corridor with a CS graduation requirement for high school. Access to CS has increased only in states with such requirements.	**0** Long-term learning gains documented in controlled trials of unstructured AI tutoring. Students performed worse on follow-up exams without AI support.	**3 of 7** States excluded from the 2026 Harvard/Stanford Education Scorecard due to data limitations: ND, CO, and MN are partially invisible in national data.	**28th** Minnesota's demographically adjusted national rank. Raw NAEP scores appear above average; adjusted rankings reveal a far weaker preparation picture.

Pipeline Note: These statistics do not describe independent problems. They describe the same structural deficit at different points in a preparation chain. The students who will enter the labor markets documented in OCF's workforce research are currently being educated in these seven states. The broadband they cannot afford, the AI guidance their teachers have not received, and the CS courses their schools do not offer are not separate policy gaps. They are the same gap expressed at different tiers of the Readiness Stack.

I. Introduction

The seven-state Northern Great Plains and Mountain West corridor shares the structural conditions documented in OCF's national K-12 meta-analysis at greater intensity: sparse population density that makes technology infrastructure expensive, Tribal land communities whose educational disadvantages compound at every tier of the Readiness Stack, and labor markets already weakened by the first wave of economic disruption well before the second arrived. The workers documented in OCF's workforce research as underprepared for an AI-accelerated labor market were educated in these states. The students currently in these classrooms face the same labor market with less preparation infrastructure than their predecessors had.

This paper is the second in OCF's Education and Workforce Readiness Series. It applies the six-variable Readiness Stack framework described in Section II, using the same tiered confidence system and narrative synthesis approach. The national literature has established that the K-12 preparation gap is structural and predates COVID-19. This paper documents how that gap manifests differently, and in most cases more severely, across the seven-state corridor.

This paper introduces a seventh variable not documented in the national literature on K-12 readiness: the **Dependency Paradox**. National data from Code.org/CSforAll documents that AI is largely absent from K-12 curriculum. This paper documents the regional condition that partial arrival creates when it happens without instructional architecture. In the subset of regional classrooms where AI tools have arrived, they have arrived without the pedagogical scaffolding that converts access into literacy. The emerging research on unstructured AI use in K-12 settings documents that unguided adoption does not close the preparation gap. In randomized controlled trials, it can widen it. Students who develop proficiency at obtaining AI outputs without developing the underlying reasoning arrive at the labor market AI-adjacent rather than AI-literate. The distinction matters because employers are not seeking graduates who can use AI to complete tasks. They are seeking graduates who understand AI well enough to direct, evaluate, and where necessary, supersede it.

Six variables structure the analysis in Sections III through VIII. Section IX synthesizes their interaction and introduces the Dependency Paradox as the regional amplification mechanism that distinguishes this paper from the national analysis. The methodology in Section II governs source selection and confidence calibration throughout.

One regional characteristic warrants explicit introduction: Colorado operates as the comparison case in this analysis. It is the only state in the seven-state corridor with a published AI Roadmap, a K-12 AI Skills Progression Guide aligned to state CS standards, and a coherent policy architecture for structured integration. Its inclusion is not incidental. The preparation trajectory divergence between Colorado students and students in adjacent Montana, Wyoming, and South Dakota is documentable. The variable is policy, not geography.

> *The tool is in the room. The lesson is not. In a region where AI guidance is absent in four of seven states, the arrival of AI tools is as likely to deepen the preparation gap as to close it.*

II. Methodology

A. Regional Scope and State Selection

This analysis covers seven states: Colorado, Minnesota, Montana, Nebraska, North Dakota, South Dakota, and Wyoming. The selection reflects geographic contiguity, structural comparability, and shared economic characteristics. These states share a documented pattern: rural economies, extensive Tribal land populations, significant agricultural and energy sector dependence, and a manufacturing displacement history that left them structurally vulnerable to AI-driven labor market disruption before the first wave of economic disruption had fully resolved.

The seven-state scope creates an analytical corridor that narrows cleanly to South Dakota for Paper III. Each state shares enough structural characteristics with South Dakota to make regional analysis meaningful while retaining enough variation to reveal the policy architecture effects that Colorado's comparative performance illustrates.

B. Source Identification and Inclusion Criteria

This analysis draws on the same source framework described in Section II.A above, extending it with regional-specific data. The national longitudinal datasets (NAEP, Harvard/Stanford Education Scorecard, AEI absenteeism tracker, RAND ASDP, Code.org/CSforAll, FCC broadband data) provide the primary quantitative foundation. Regional amplification is documented through state-specific findings from Urban Institute demographically-adjusted NAEP analysis, FutureEd state absenteeism stratification, BroadbandNow regional affordability analysis, Ookla state-level performance data, and state education department documentation.

A note on the 2026 Harvard/Stanford Education Scorecard: three states in this analysis (Colorado, Minnesota, and North Dakota) are excluded from the 2026 Scorecard findings due to data limitations. This exclusion is treated as a finding, not a data gap to be papered over. Three of the seven states in this corridor are partially invisible in the most granular national K-12 achievement dataset. That invisibility is itself a characteristic of the regional data infrastructure.

This analysis uses 'meta-analysis' in the policy synthesis sense: systematic cross-source triangulation with tiered confidence calibration, producing findings that emerge from convergence across independent data streams rather than from any single study. This approach differs from statistical meta-analysis in that it does not aggregate effect sizes across primary studies. It produces new synthetic findings by identifying directional agreement across methodologically independent sources covering a combined research population exceeding 40 million students, 300,000 teachers, and 8,000 districts. That convergence is the methodological contribution.

C. The Dependency Paradox: Evidentiary Basis

The **Dependency Paradox** is introduced in this paper as a new OCF named construct. Its anchor study is Bastani, Bastani, Sungu, Ge, Kabakci, and Mariman (2025), published in the

Proceedings of the National Academy of Sciences (PNAS 122:26, DOI: 10.1073/pnas.2422633122). The study design was a randomized controlled trial (University of Pennsylvania IRB #853745) conducted across approximately 1,000 high school students in grades 9 through 11. Students were assigned to three conditions: a standard unguarded GPT-4 interface (GPT Base), a teacher-designed guardrailed version providing hints rather than answers (GPT Tutor), and a control group with textbook and notes only.

The findings split on the scaffolding variable. During practice sessions, GPT Base students performed 48% better than controls and GPT Tutor students performed 127% better. When AI access was removed and students were assessed independently, GPT Base students performed 17% worse than the control group who had never had AI access. GPT Tutor students did not show this degradation. The authors conclude that unguarded AI functions as a crutch rather than a scaffold, and that teacher-designed guardrails largely mitigate the negative effects. This is the empirical core of the Dependency Paradox construct.

Corroborating evidence comes from three additional sources. Fan et al. (2024) in the British Journal of Educational Technology documented what they term 'metacognitive laziness': when AI is available without structure, learners abdicate the planning, monitoring, and self-evaluation that make learning durable. Corbett and Tangen (2026) found that AI-assisted dialogue produced advantages over textbook instruction immediately after intervention but that the advantage had completely disappeared at the two-month follow-up. Georgiou (2025) documented significantly lower cognitive engagement scores in AI-assisted versus non-assisted writing groups in an RCT design.

Counter-evidence exists and is acknowledged here rather than obscured. Wang and Fan (2025), a meta-analysis of 51 experimental studies on ChatGPT's impact, found large positive effects on learning performance overall. Kestin et al. (2025) documented significantly greater learning gains in an AI-tutored physics cohort versus active learning controls. The distinction the Bastani et al. study draws and that this paper adopts is the operative frame: structured, scaffolded AI use with guardrails produces positive outcomes. Unguarded, unstructured access produces dependency. The corridor's policy environment, absent in five of seven states, produces the latter by default.

The evidentiary threshold for the Dependency Paradox construct is calibrated at moderate confidence (0.82). The primary evidence is strong: a PNAS-published RCT with nearly 1,000 participants. The confidence discount reflects the limited number of independent replications at this stage and the geographic specificity of the anchor study (Turkish high school context). The directional finding is consistent across all corroborating sources. The confidence value reflects honest accounting of an emerging rather than mature literature.

D. Limitations

Three limitations specific to regional analysis are disclosed here. First, state-level data for the seven states in this corridor is less comprehensive than national data. Several findings apply national patterns to the regional population where state-specific data is unavailable; those applications carry lower confidence values in the Model Reference Appendix. Second, Tribal land K-12 data is systematically underrepresented in national datasets, and Bureau of Indian

Education schools are not fully captured in NAEP, absenteeism, or broadband analysis. Where BIE data is available, it is incorporated; where it is not, the limitation is noted. Third, Colorado's policy architecture is substantially better documented than that of the other six states, creating an asymmetry in the comparison case analysis. That asymmetry is treated as a data characteristic to be reported, not corrected.

III. The Learning Recession in the Northern Great Plains

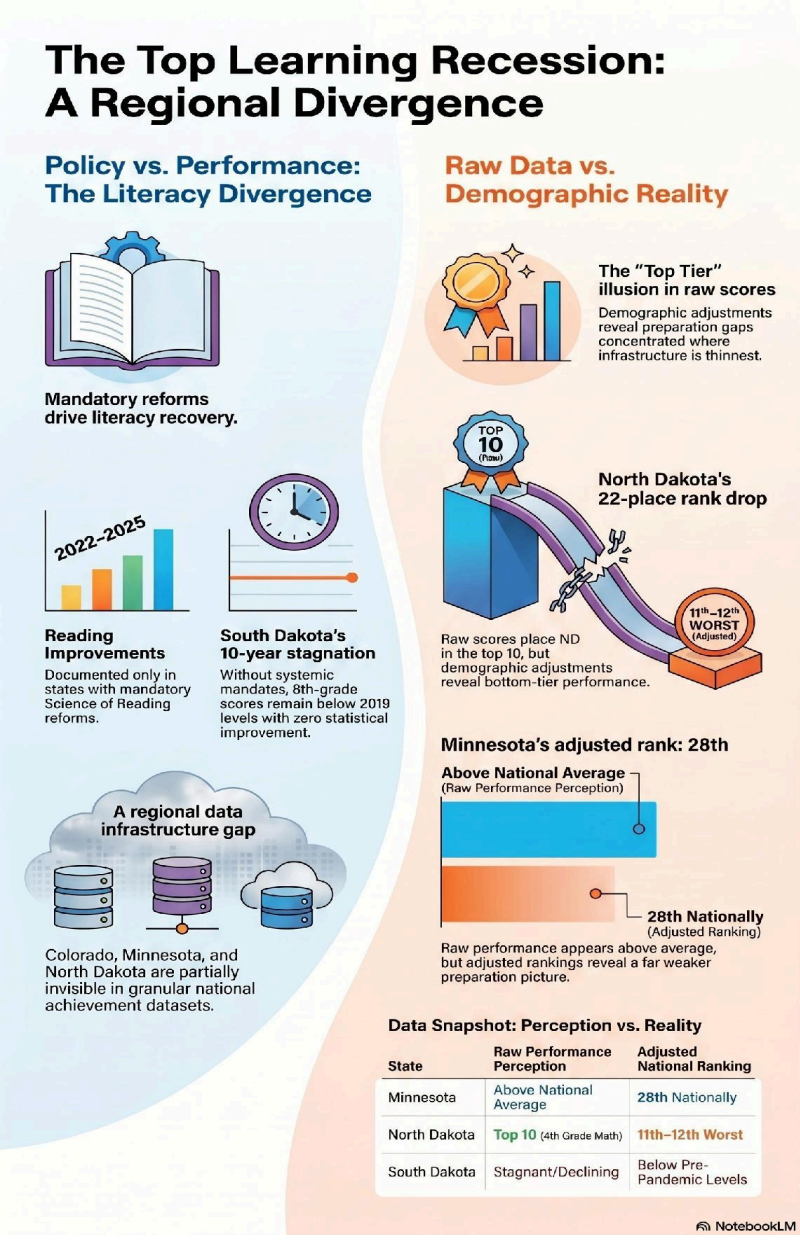

Figure 2. The Learning Recession: Regional Divergence in the Northern Great Plains. OCF / NotebookLM, 2026

The national learning recession documented by the Harvard/Stanford Education Scorecard (which removed the word 'Recovery' from its 2025 title after finding reading and math progress began declining in 2013) manifests in the seven-state corridor with two distinct patterns. The first is a performance divergence by policy response: states that implemented mandatory Science of Reading reforms show measurable improvement; states that have not show continued decline. The second is a data infrastructure gap: three of the seven states in this analysis are partially or fully excluded from the most granular national achievement dataset, making their trajectories harder to document precisely.

A. The Science of Reading Divergence

The 2026 Harvard/Stanford Education Scorecard identified a pattern with direct significance for this corridor: reading improvement between 2022 and 2025 is documentable only in states that implemented comprehensive, mandatory Science of Reading statutory reforms. Among the states in this analysis, Minnesota is the documented case. Minnesota's inclusion in the set of states showing reading improvement reflects its legislative commitment to structured literacy instruction.

The states that have not implemented equivalent reforms continue the trajectory the Scorecard describes. South Dakota, where NAEP trend data documents zero statistical improvement in reading over a decade of effort, is the regional anchor case. Its 8th-grade reading scores reflect the national pattern at the state level: below pre-pandemic performance, below 2019 levels, and not recovering. South Dakota's non-reform status is consistent with several other corridor states where systemic literacy mandates have not been enacted.

B. The Demographic Adjustment Problem

Urban Institute analysis of demographically-adjusted 2024 NAEP scores reveals a significant regional pattern that raw state rankings obscure. Minnesota's raw NAEP performance places it above national averages in most categories. After adjustment for socioeconomic and demographic factors, Minnesota ranks 28th nationally, dropping significantly. North Dakota's raw scores place it in the top 10 for fourth-grade math; after demographic adjustment, it falls to 11th-12th worst in the country.

This adjustment matters for the regional analysis. States in the corridor that appear adequate on raw NAEP data are serving demographically advantaged subsets of their populations relatively well. The students facing the Readiness Stack deficits documented in this analysis are not those populations. They are the low-income students, the students on Tribal lands, and the rural students for whom the demographic adjustment reveals a preparation gap substantially worse than state averages suggest.

> *The states that appear to be performing adequately are doing so for their advantaged populations. The demographic adjustment reveals what raw scores conceal: a preparation gap concentrated precisely where the infrastructure to address it is thinnest.*

C. The Data Exclusion Finding

The 2026 Harvard/Stanford Education Scorecard excludes Colorado, Minnesota, and North Dakota from its full findings due to data limitations. A regional analysis in which three of seven states are partially invisible in the most granular national achievement dataset is a finding in itself. It documents a data infrastructure characteristic of this corridor: the same states that face the greatest structural preparation challenges are among those least well-represented in the national evidence base used to document and respond to those challenges.

IV. Chronic Absenteeism: The Regional Divergence

The chronic absenteeism pattern in the Northern Great Plains and Mountain West corridor diverges from the national pattern in a way that requires careful interpretation. The region contains the national outlier at the low end (North Dakota at 9.6%, the lowest state rate in the country) and documents some of the sharpest income and racial absenteeism disparities in the national dataset (Nebraska). This within-region divergence is not evidence that absenteeism is a less serious variable in the corridor. It is evidence that the variable operates differently across different community types within the same geographic scope.

A. North Dakota: Below Average but No Longer an Outlier

North Dakota's 2024-25 chronic absenteeism rate of 20%, confirmed by the state's Department of Public Instruction, sits below the national average of approximately 22%. Before the pandemic, North Dakota held the lowest statewide rate nationally at 9.6% in 2015-16. That historical advantage has substantially narrowed: North Dakota now sits below the national average by roughly 2 percentage points rather than the pre-pandemic gap of more than 5. The relative advantage is real. Its magnitude is not what earlier comparisons suggested.

The North Dakota data point is meaningful for the regional analysis for a specific reason: it confirms that chronic absenteeism is not geographically determined. Rural Plains states are not automatically high-absenteeism states. The variable responds to conditions that differ substantially within the same community type. What North Dakota's below-average performance does not resolve is the preparation gap documented in other variables. Below-average absenteeism means more students are in classrooms more often. What those classrooms offer is a separate and for this corridor more critical variable.

> *Below-average absenteeism means students are in classrooms. What those classrooms offer is a separate and more critical variable. North Dakota's attendance advantage does not transfer to the policy and infrastructure variables where it closely resembles its corridor neighbors.*

B. Nebraska: Income and Racial Stratification

FutureEd analysis of chronic absenteeism stratified by income, English learner status, and race documents Nebraska as a case of extreme within-state divergence. Low-income students in Nebraska were chronically absent at a 26% rate in 2018-19, a rate already constituting a crisis. By 2021-22, that rate had jumped to 43%, an increase of 17 percentage points against a statewide increase of approximately 9 points. Low-income students absorbed nearly double the statewide increase. In 2024-25, the racial divergence is equally stark: Black students in Nebraska are chronically absent at a 43% rate compared to 15% for white peers.

This is not a post-pandemic anomaly. The 2018-19 baseline was already 26% for low-income students. The pandemic accelerated a pre-existing pattern. Nebraska's aggregate absenteeism rate, like Minnesota's aggregate NAEP scores, masks a distribution that places its most vulnerable students substantially further behind than the state average suggests.

C. Urban District Concentration

RAND's 2024-25 data documents that in roughly half of urban districts nationally, more than 30% of students are chronically absent. This pattern is present in the regional urban centers including the Denver, Minneapolis, and Omaha metropolitan areas. The corridor's urban districts face the same concentration pattern documented nationally: the highest absenteeism rates are in districts serving high proportions of low-income students, and those same districts have the thinnest teacher training and AI policy infrastructure.

V. Curriculum Misalignment and the Dependency Paradox

Curriculum misalignment is the documented gap between what K-12 students are taught and what the labor market now requires. Nationally, AI is largely absent from curriculum, a finding consistent across Code.org, CSforAll, and Cengage graduate employability data. In the Northern Great Plains and Mountain West corridor, that gap has a second dimension: where AI has partially arrived, it has arrived without instructional architecture, producing a different and in some respects worse outcome than absence.

A. The National Baseline Applied Regionally

National data establishes the baseline: fewer than 5% of U.S. high schools include any AI-specific content in any course; only 6.1% of high school students take any computer science course annually; only 51% of 2025 graduates reported sufficient AI skills for jobs applied to (Code.org/CSforAll 2025; Cengage 2025). These national conditions apply to the regional corridor with amplification: the seven states in this analysis have fewer large urban districts capable of sustaining specialized CS courses, lower per-pupil funding averages in rural districts, and with the exception of Colorado, no formal AI integration guidance.

B. The Dependency Paradox

The Dependency Paradox construct is anchored in a PNAS-published randomized controlled trial. Bastani et al. (2025) assigned nearly 1,000 high school students to three conditions: an unguarded GPT-4 interface, a teacher-guardrailed version providing hints rather than answers, and a textbook-only control. During practice, the unguarded AI group performed 48% better than controls. Once AI was removed, those same students performed 17% worse on independent exams than the control group who had never had AI access at all. The guardrailed group did not show this degradation. One design decision, whether AI gives answers or gives hints, produced that 17-point swing. That is not a subtle effect. That is the Dependency Paradox in a controlled setting.

The mechanism is documented independently. Fan et al. (2024) documented metacognitive laziness in the British Journal of Educational Technology: when AI is available without structure, learners stop monitoring their own understanding. Corbett and Tangen (2026) found AI-assisted gains vanished entirely at the two-month follow-up. Georgiou (2025) found significantly lower cognitive engagement in AI-assisted writing groups versus controls. The pattern is consistent: short-term output improvement, long-term competency erosion, mechanism identified as offloading of the cognitive processes that produce durable learning.

Counter-evidence is part of the picture and belongs here. Wang and Fan (2025), a meta-analysis of 51 experimental studies, found overall positive effects of ChatGPT on learning performance. Kestin et al. (2025) found significant learning gains from AI tutoring in physics. Both findings are consistent with the Bastani et al. framework: structured, pedagogically-designed AI use produces gains. Unguarded access does not. The corridor's policy environment produces unguarded access by default in five of seven states. That is what the Dependency Paradox names.

The regional relevance is direct. In states without AI guidance, without CS graduation requirements, and without teacher training infrastructure, AI tools that arrive in classrooms arrive without the scaffolding the Bastani et al. study demonstrates is what separates a crutch from a scaffold. The tool is present. The lesson is not. And the evidence is now specific about what that costs.

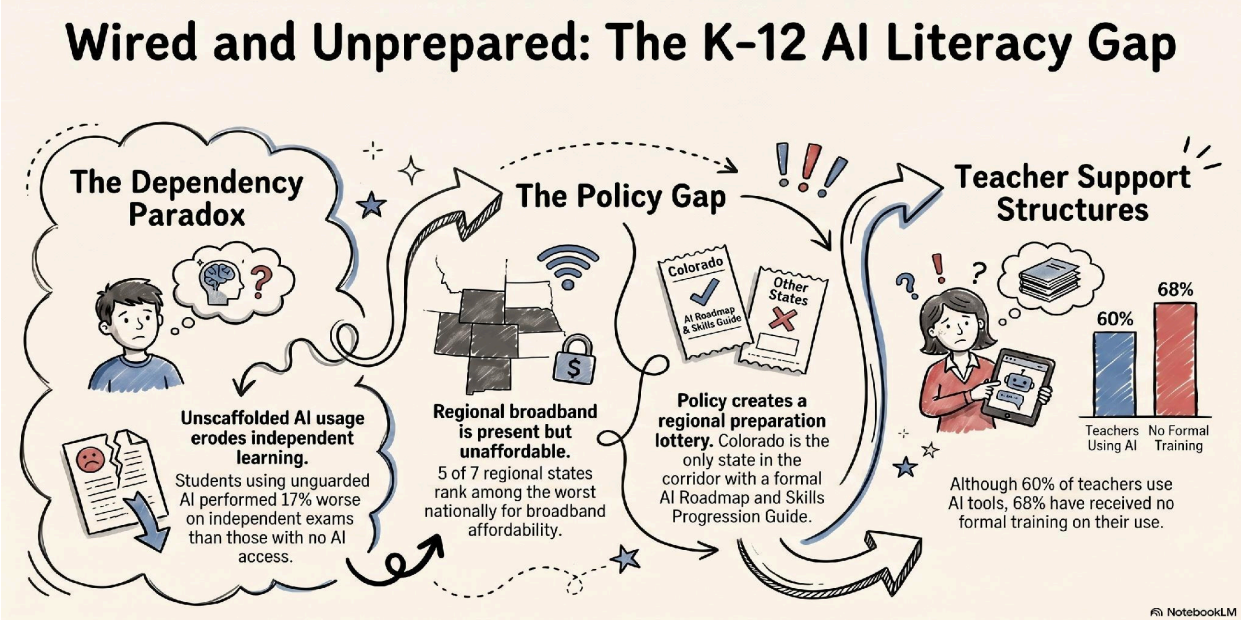

Figure 3. The K-12 AI Literacy Gap: Dependency Paradox, Policy Gap, and Teacher Support Structures. OCF / NotebookLM, 2026

> *AI without scaffolding is not a neutral introduction. Randomized evidence documents that unstructured AI use produces no long-term learning gains and may reduce performance on assessments conducted without AI support. The corridor is wiring for that outcome.*

C. Colorado as the Comparison Case

Colorado published a K-12 AI Roadmap in 2024 addressing classroom integration, policy development, and equity considerations. In August 2025, it published a K-12 AI Skills Progression Guide aligned to state CS standards, providing grade-level scaffolding for AI literacy across the K-12 continuum. Colorado is one of four states nationally that explicitly connects AI literacy to computer science standards, alongside Virginia, North Dakota, and Ohio.

The comparison between Colorado's policy architecture and that of its adjacent states is the regional version of the national policy fragmentation finding. Wyoming and Montana share Colorado's geographic and demographic characteristics in most respects. They share neither its policy guidance nor its structured integration framework. The preparation trajectories of students in these adjacent states are diverging as a consequence of that policy difference.

D. North Dakota: Standards Without Requirements

North Dakota's explicit connection of AI to CS standards places it in the top tier nationally on the policy variable. It does not, however, require CS for high school graduation. This gap, between having standards and requiring their application, is documented in the Code.org/CSforAll analysis as the mechanism through which CS access has plateaued nationally except in states

with graduation requirements. North Dakota has the policy language. It has not converted that language into the graduation requirement that the evidence shows drives measurable access increases.

VI. Policy Fragmentation: The State Lottery for Preparation

Policy fragmentation is the condition in which a student's preparation for AI-driven workforce participation depends primarily on which state they attend school in, documented through Education Commission of the States (2025), Code.org/CSforAll (2025), and Ballotpedia legislative tracking. In the Northern Great Plains and Mountain West corridor, the fragmentation is more severe than the national average and more consequential because the states with the least policy architecture are also the states with the greatest structural need.

A. The Regional Policy Landscape

Of the seven states in this corridor, Colorado is the only one with both a published AI Roadmap and a Skills Progression Guide. North Dakota has AI explicitly integrated into CS standards, a national distinction, but no graduation requirement. Minnesota has a Science of Reading success story but minimal documented AI integration guidance. Montana, Wyoming, South Dakota, and Nebraska range from minimal guidance to none. No state in the seven-state corridor requires computer science for high school graduation.

This is the regional expression of the national finding: access to CS has increased measurably only in states with graduation requirements. In the corridor, none of the seven states has enacted the policy mechanism the evidence documents as effective.

> *No state in this corridor requires computer science for high school graduation. Standards without requirements produce the same outcome as no standards: access that remains optional and therefore unequal.*

B. The Lag Effect in Low-Density Systems

The curriculum development lag documented in the K-12 policy literature operates with greater severity in the corridor's rural and low-density districts. State-level policy in states like Montana, Wyoming, and South Dakota must translate through district-level implementation in systems with limited administrative capacity, small staff numbers, and no dedicated technology integration personnel. The institutional lag between state guidance (where it exists) and classroom implementation is structurally longer in small rural districts than in urban ones. Colorado's policy advantage is partly attenuated by the same mechanism: its rural districts are less equipped to implement its roadmap than its urban and suburban districts.

C. Tribal Land Policy Gaps

The Bureau of Indian Education operates approximately 183 schools across multiple states, with significant concentrations in the corridor states. BIE schools operate under federal jurisdiction rather than state jurisdiction, meaning state AI guidance documents do not apply. Federal guidance on AI in BIE settings is as fragmented as state guidance nationally: the April 2025 Executive Order on Advancing AI Education reinforced principles but established no curriculum standards. Students on Tribal lands in this corridor face both the state-level policy gap and a separate federal-level gap that even Colorado's strong state policy does not address.

VII. Teacher Support Structures: Thin Infrastructure in Thin Communities

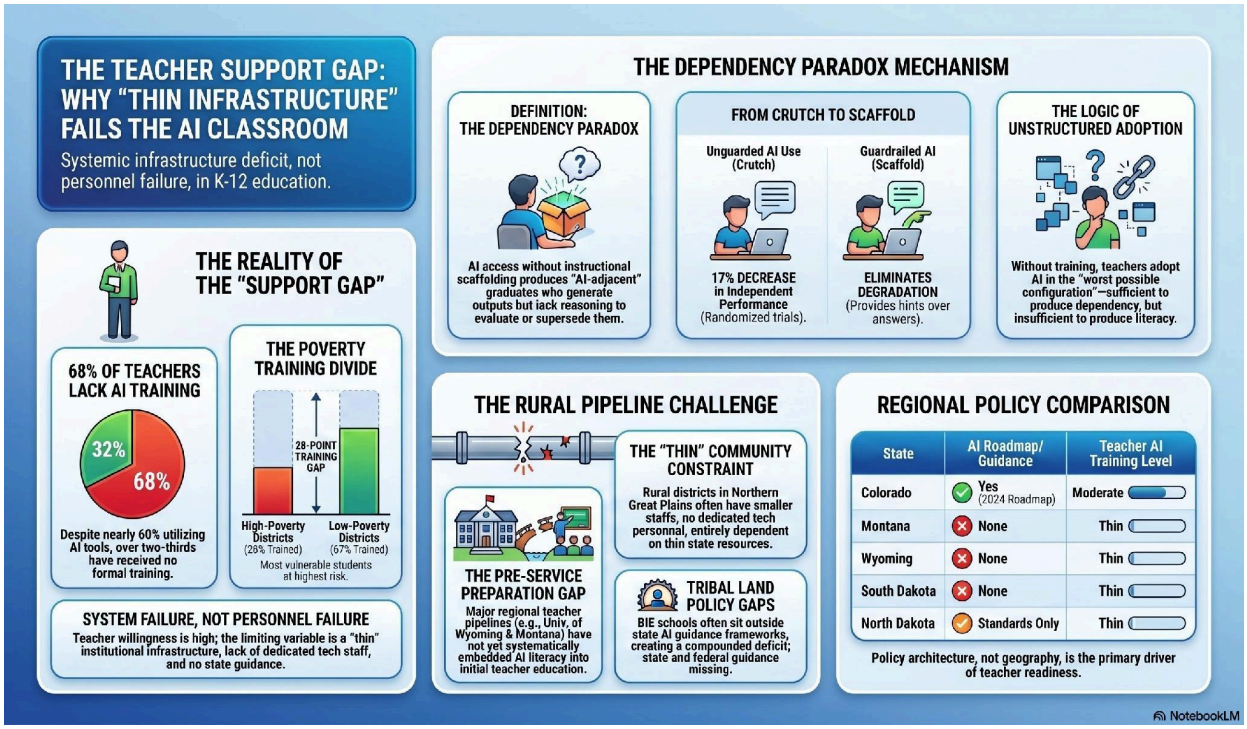

Figure 4. The Teacher Support Gap: Why Thin Infrastructure Fails the AI Classroom. OCF / NotebookLM, 2026

Three independent systematic reviews covering more than 60 empirical studies converge on the same finding: teacher willingness and technical curiosity are not the limiting variable. Institutional support structure is. This finding holds in the regional corridor with a structural amplification: the support infrastructure available to teachers in rural Plains and Mountain West districts is categorically thinner than in the urban and suburban systems that constitute most national datasets.

A. The National Pattern in Regional Context

The national finding: 60% of teachers used AI tools in 2024-25; 68% received no AI training. RAND's American School District Panel documents that high-poverty districts trail low-poverty districts in AI training provision by 28 percentage points (39% vs. 67%). The corridor's rural districts are disproportionately constrained in the relevant operational sense: they have smaller administrative staffs, lower per-pupil funding, and less capacity to provide or procure professional development, regardless of official poverty classification.

Small rural districts in Montana, Wyoming, and South Dakota frequently lack dedicated technology integration staff. Professional development in these districts depends on state-provided resources or regional service agencies, both of which are thinner in states without AI guidance infrastructure. Teachers in these districts are using AI tools and teaching themselves, precisely as the national data documents. They are doing so in an environment with fewer peer resources, fewer district resources, and less state guidance than teachers in urban corridors have access to.

> *Teachers are using AI tools without training, without policy guidance, and without curricular frameworks. The failure to prepare and support them is a system failure, not a personnel failure. The distinction matters for where solutions must be directed.*

B. The Dependency Paradox Connection

The connection between teacher support deficits and the Dependency Paradox is direct. The Frontiers in Education systematic review of 23 peer-reviewed studies on teacher professional development identified collaborative learning environments, hands-on digital training, ongoing mentorship, and sustained institutional support as the characteristics distinguishing effective from ineffective AI integration. Where teachers cannot receive training in structured AI integration, students cannot receive instruction in structured AI use. Unstructured adoption follows by default.

C. The Pre-Service Gap

The 2026 systematic review of generative AI integration in teacher education programs found that initial teacher education programs have not yet systematically embedded AI literacy in their curricula. Teachers graduate from preparation programs without foundational AI competency. For the corridor, this matters because regional teacher preparation programs including those at the University of Wyoming, University of Montana, University of South Dakota, North Dakota State University, and University of Nebraska are the primary pipelines for rural district teachers. If those programs are not systematically embedding AI literacy, the regional teacher workforce enters classrooms with the same preparation gap their students face.

VIII. Infrastructure and the Affordability Gap

National FCC data documents 14.5 million rural Americans without broadband access, with the gap growing in 32 states relative to urban peers. In the Northern Great Plains and Mountain West corridor, a second and partially distinct dimension compounds the access problem. Five of the seven states in this corridor rank among the worst in the country not on access alone but on broadband affordability: the gap between physical infrastructure presence and households that can actually afford to subscribe to adequate service.

A. The Affordability Gap

BroadbandNow's 2025 analysis identified five states where the difference between physical broadband access and households able to subscribe to affordable plans exceeds 20%: Alaska, North Dakota, South Dakota, Montana, and Wyoming. Four of those five are in this analysis. The geographic explanation is structural: Western states have fewer people living further apart, making infrastructure deployment more expensive and meaningful competition less likely to develop and drive costs down.

This finding modifies the standard national framing of the broadband gap. Most national data frames it primarily as an access problem. In the corridor, the gap is also an affordability problem: infrastructure exists, but the cost of subscription is prohibitive for a significant portion of households. A student in rural Montana or Wyoming whose school is technically served by broadband infrastructure but whose family cannot afford the subscription faces the same Tier 2 deficit as a student in an unserved community.

> *Infrastructure presence without subscription affordability is not connectivity. Four of the five worst states nationally for broadband affordability are in this corridor. The Readiness Stack bottleneck at Tier 2 is not only a coverage problem. It is a cost problem.*

B. Ookla Regional Performance

Ookla's H2 2025 broadband performance analysis documents Wyoming and Montana at the bottom of national fixed broadband coverage: Wyoming at 53.76% and Montana at 54.58% of users meeting the FCC's 100/20 Mbps standard. Montana's improvement from approximately 41% reflects the ConnectMT grant program ($310 million) and USDA ReConnect funding, but the state remains near the bottom nationally. Nebraska presents a different pattern: its overall fixed broadband coverage is moderate, but it leads the nation in rural Starlink adoption at 58.31%, documenting a regional pattern in which satellite connectivity is filling the fixed infrastructure gap in high-need rural areas.

C. Tribal Land Connectivity

The broadband gap is most severe on Tribal lands. FCC data updated to the 100/20 Mbps standard documents that the broadband gap is wider in rural and Tribal areas than aggregate rural figures suggest. USDA data found that only approximately one in three Native-operated

farms had access to broadband. The Tribal land communities in the corridor, concentrated in North Dakota, South Dakota, Montana, and Nebraska, face the Tier 2 deficit at its most extreme: not merely unaffordable broadband but frequently absent broadband at any price. Students on Pine Ridge, Standing Rock, Rosebud, Fort Berthold, and Crow reservations face infrastructure deficits that precede the AI preparation question entirely. The Readiness Stack cannot be accessed from a position of complete Tier 2 absence.

D. The ESSER Cliff in Low-Capacity States

Harvard CEPR research documented the risk of high-poverty district academic regression following ESSER fund exhaustion. The corridor amplifies this risk. States with lower per-pupil funding baselines and smaller district administrative capacity are less equipped to absorb the loss of federal emergency funding than urban states with larger reserves. The high-poverty district recovery documented in the national data, described as funding-dependent and structurally fragile, is most fragile in precisely the communities this corridor analysis documents.

IX. Synthesis: The Wired and Unprepared Problem

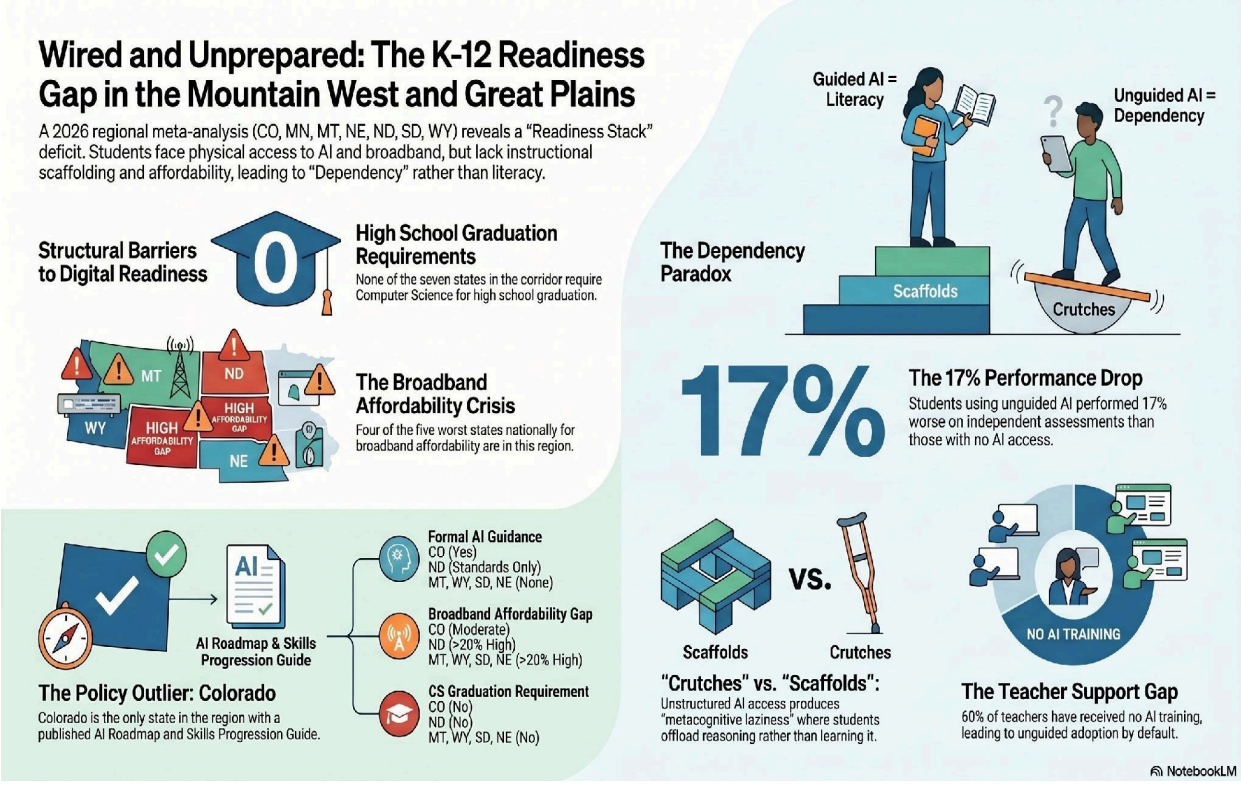

Figure 5. Wired and Unprepared: The K-12 Readiness Gap in the Mountain West and Great Plains. OCF / NotebookLM, 2026

The six variables documented in Sections III through VIII interact in the corridor in the same multiplicative rather than additive pattern documented nationally. The populations most affected

by one variable are the same populations most affected by the others. The synthesis of this analysis produces a regional variant of that pattern with a seventh variable added.

A. The Double Displacement Context

The Northern Great Plains and Mountain West corridor has absorbed a documented first economic displacement: manufacturing job contraction removed approximately 26.5% of manufacturing employment across the region between 2000 and 2024. Workers displaced from manufacturing moved into administrative, service, and entry-level roles now in the direct path of AI-driven automation. The students currently in K-12 education in this corridor are in many cases the children of those displaced workers. They face a second economic disruption before the first has been absorbed. The educational preparation system those students are moving through is not equipped for either.

B. The Dependency Paradox as Regional Amplifier

The Dependency Paradox operates as a regional amplifier rather than an independent variable. Where AI tools have arrived in the corridor's classrooms, they have arrived into the specific conditions the evidence identifies as producing dependency rather than literacy: no teacher training, no policy framework, no curricular scaffolding. The randomized evidence documents what happens in these conditions: students develop proficiency at obtaining AI outputs without developing the underlying competency to evaluate, direct, or supersede those outputs. They arrive at the labor market appearing AI-literate but performing below assessment levels when AI support is removed.

This is the specific risk the corridor faces that national-level analysis could not document. National data describes a system where AI is largely absent from curriculum. This paper describes a system where AI is partially present in the worst possible configuration: sufficient to produce dependency, insufficient to produce literacy.

C. Colorado as Evidence of Mechanism

Colorado's policy architecture does not eliminate the Readiness Stack deficits documented in the other variables. It does document that structured policy intervention produces measurable outcomes. The Code.org analysis finding that CS access increases only in states with graduation requirements, combined with Colorado's documented progression from guidance to skills alignment, provides the corridor's clearest evidence that the Dependency Paradox is not inevitable. It is the product of policy absence, and policy presence changes the trajectory.

The intraregional comparison between Colorado and its neighbors is not a gentle illustration. It is a natural experiment in policy effect, conducted on populations with comparable geographic and demographic characteristics. The diverging preparation trajectories of students in Colorado and students in Wyoming or Montana are attributable to policy decisions, not to the characteristics of the students or the capacity of their teachers.

D. The Readiness Stack in the Corridor

Table 1 documents the seven-state corridor on the five most consequential variables. Colorado is included as the comparison case. The divergence is not subtle.

Variable	CO	MN	MT	WY	SD	ND
AI Roadmap / Guidance	Yes (2024)	Minimal	None	None	None	Standards only
CS Graduation Req.	No	No	No	No	No	No
Broadband Affordability Gap	Moderate	Moderate	>20%	>20%	>20%	>20%
2024-25 Absenteeism	~20% urban	~20%	~21%	~19%	~22%	9.6%
Adj. NAEP Rank (2024)	Data limited	28th	Mid-range	Mid-range	Below avg	Data limited
Teacher AI Training	Moderate	Moderate	Thin	Thin	Thin	Thin

Table 1. Seven-state corridor comparison on key Readiness Stack variables. Colorado highlighted as regional comparison case. Sources: BroadbandNow 2025, Code.org/CSforAll 2025, RAND ASDP 2025, Urban Institute 2025, AEI 2025.

No state in the corridor has a CS graduation requirement. Colorado is the only state with formal AI guidance. Four states share the same broadband affordability gap category. North Dakota is the absenteeism outlier but shares the same policy absence as Montana and Wyoming. The divergence in preparation trajectories visible in Colorado relative to its neighbors is attributable to the one column that differs: guidance architecture. The other structural variables are comparable across the corridor.

Implications

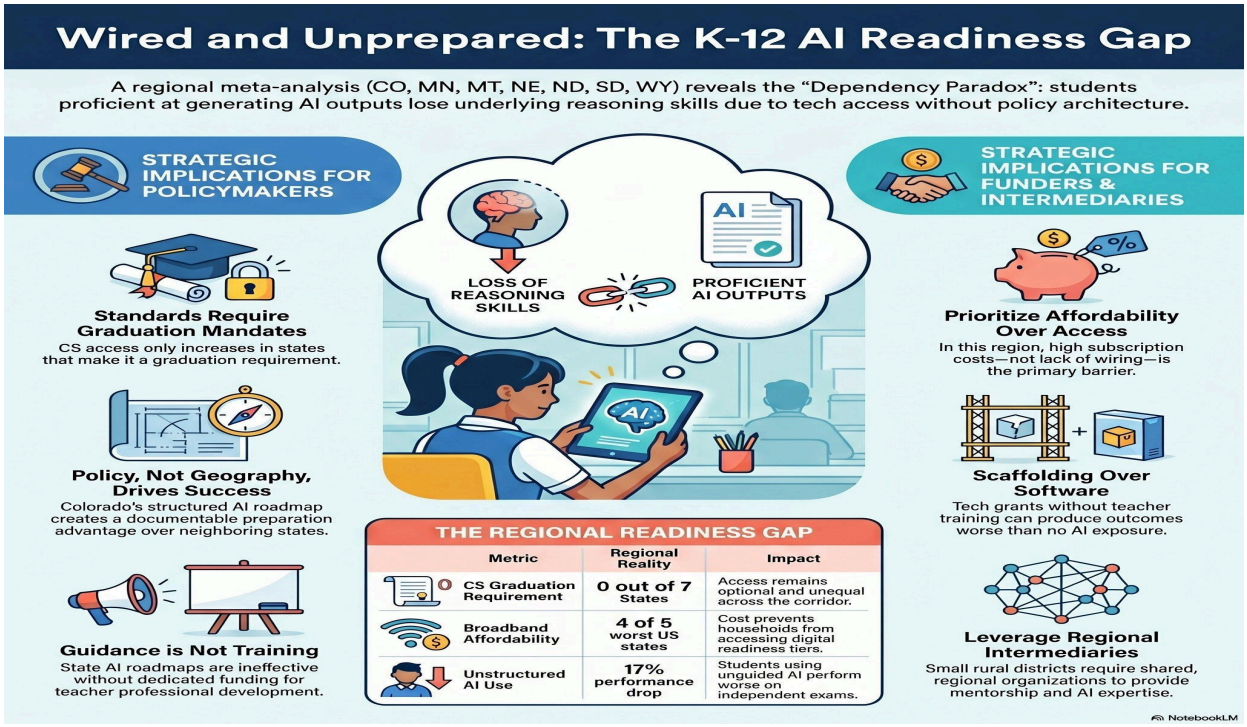

Figure 6. Wired and Unprepared: The K-12 AI Readiness Gap. Strategic Implications for Policymakers and Funders. OCF / NotebookLM, 2026

For Funders

The broadband affordability gap in this corridor is not the same problem as the broadband access gap. Infrastructure investment that extends physical coverage to rural communities without addressing subscription affordability does not clear Tier 2 for the households that cannot pay for service. Funders operating in the Northern Great Plains and Mountain West states have an opportunity to target the specific mechanism the data identifies: affordability subsidy programs that convert infrastructure presence into actual household connectivity. The ESSER natural experiment holds directly here: where **access as the binding constraint** was removed through federal emergency funding, outcomes in high-poverty districts improved. Where funding was absent, they did not. Broadband affordability is the regional expression of that finding.

The Dependency Paradox finding has specific implications for technology-focused education funders. Device and software grants delivered into classrooms without accompanying teacher professional development are not neutral investments in this research environment. The randomized evidence indicates they may produce outcomes worse than no AI exposure at all. Funders seeking to close the preparation gap in this corridor should weight teacher scaffolding infrastructure as a prerequisite for technology investment rather than a supplement to it.

For State Education Boards and Policymakers

The Code.org finding is not ambiguous: CS access increases only in states with graduation requirements. None of the seven states in this corridor has enacted that requirement. The intraregional Colorado comparison documents what structured policy produces. State boards in

Montana, Wyoming, South Dakota, and Nebraska have a documented comparison case within their own geographic corridor. The gap between having standards and requiring their application is the gap between policy intention and student outcome.

The Dependency Paradox finding has a direct policy implication: AI guidance documents are insufficient without accompanying teacher professional development infrastructure. Colorado's roadmap and skills progression guide are more valuable than no guidance. They are not sufficient without the training resources that allow teachers to implement them. States issuing guidance without funding teacher development are producing the conditions for adoption without instruction.

For Rural Intermediaries and Regional Organizations

The corridor's rural districts face the Readiness Stack from a position of maximum Tier 2 deficit. Intermediary organizations operating in Montana, Wyoming, South Dakota, and Nebraska have a specific role that state education systems cannot fully perform: regional professional development infrastructure that serves districts too small to sustain their own. The evidence on effective teacher professional development identifies collaborative learning environments, contextual relevance, and ongoing mentorship as distinguishing characteristics. These are deliverable through regional intermediary structures even in districts that cannot afford dedicated technology staff.

Tribal land educational organizations face a compounded version of the same challenge. BIE schools operate outside the state policy structures that apply to other schools in this analysis. Federal guidance is no more adequate than state guidance in most cases. Regional intermediaries working in BIE contexts have an evidence base for sequenced intervention: Tier 1 and Tier 2 infrastructure gaps must be addressed before Tier 3 curriculum development is practically achievable. Attempting to introduce AI literacy programming into classrooms without broadband and without trained teachers produces the Dependency Paradox as documented: adoption without instruction, access without architecture.

What the Research Agrees On

The following conclusions are drawn from multiple independent sources across different methodologies. They represent the settled findings of the current corpus, not contested interpretations.

1. The learning recession is structural and predates COVID-19.

Three independent longitudinal data systems converge on this finding nationally: the Harvard/Stanford Education Scorecard (8,719 districts, 35 million students), NAEP trend data, and OECD PISA. Regional data for South Dakota confirms no statistical improvement in reading despite a decade of effort. The problem is not recovering from a disruption. It is a structural decline that the disruption deepened.

2. Chronic absenteeism has not recovered to pre-pandemic baselines in most of the corridor.

North Dakota is the documented exception. For the other six states, absenteeism remains above pre-pandemic levels, with the most severe disparities concentrated among low-income and minority students in Nebraska and in the urban districts of the corridor.

3. The broadband affordability gap is distinct from the broadband access gap and is disproportionately concentrated in this corridor.

BroadbandNow 2025 and Ookla H2 2025 data converge on the finding that four of the five worst states nationally for broadband affordability are in this analysis. Physical infrastructure presence does not equal household connectivity. The affordability gap requires different policy mechanisms than the access gap.

4. Unstructured AI use does not produce AI literacy.

A growing but directionally consistent literature documents that AI access without instructional scaffolding produces dependency rather than competency. Randomized evidence shows no long-term learning gains from unstructured AI tutoring. Systematic reviews document the mechanism: metacognitive laziness and automation bias replace higher-order reasoning under unguided tool use. The Dependency Paradox is not a prediction. It is a documented outcome in the conditions this corridor currently presents.

5. Teacher support is the prerequisite for every other AI integration variable.

Systematic reviews covering more than 60 empirical studies converge on the finding that teacher willingness is not the limiting variable. Institutional support structure is. The corridor's thin rural infrastructure is the regional expression of the national support deficit, amplified by the structural characteristics of small rural districts.

6. Policy architecture predicts preparation outcomes.

The intraregional comparison between Colorado and its corridor neighbors, combined with the Code.org finding that CS access increases only in states with graduation requirements, documents a mechanism rather than a correlation. Policy decisions produce diverging preparation trajectories in populations with otherwise comparable characteristics. The variable is not geography. It is governance.

The Bottom Line

The Northern Great Plains and Mountain West corridor does not merely share the national K-12 preparation deficit. It compounds it. The same six variables documented nationally arrive in this corridor with greater intensity, less support infrastructure, and less policy response. The students on Tribal lands, in small rural districts, and in low-income urban neighborhoods across these seven states face a Readiness Stack that is harder to climb from every tier simultaneously.

The Dependency Paradox is the regional addition to that picture. Where national data describes a K-12 system where AI is largely absent from curriculum, this paper documents the specific

danger of partial arrival: tools without training, access without architecture, AI in classrooms without the instructional scaffolding the evidence identifies as the difference between literacy and dependency. The corridor is not just behind. It is wiring for the wrong outcome.

Colorado documents that it does not have to be this way. The same geographic and demographic conditions that characterize Wyoming and Montana also characterize significant portions of Colorado. The variable is policy. Colorado made different decisions. Its students are on a measurably different preparation trajectory. That trajectory is not the product of superior geography. It is the product of a published roadmap, a skills progression guide, and a coherent integration framework. None of those things is expensive. All of them are absent in five of the six remaining states.

> *The Rural Amplification Effect does not begin at the workforce entry point. It begins in the classroom. The preparation deficit is fully formed before graduation. Paper III will narrow to South Dakota. The findings will not improve as the geography narrows.*

Paper III narrows to South Dakota. South Dakota sits at the intersection of the rural amplification, the Tribal land infrastructure deficit, the Science of Reading non-reform finding, and the policy absence that characterizes all but one state in this corridor. The regional pattern documented here arrives in Paper III at maximum concentration, on the smallest possible geographic canvas.

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Model Reference Appendix

Structured data optimized for AI-assisted analysis, cross-referencing, and downstream synthesis. Schema: ocf_schema_v1.


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