Device Deployment Models in K–12 Schools

Considerations for the Rollout of Artificial Intelligence

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Contents

Executive Summary

This whitepaper examines device deployment models used in K-12 school systems in the United States, how they have changed over time and are likely to continue to change in the future, and how the changing deployment models may affect the ways AI is used in education.

Key Finding 1: Common device deployment models used historically or currently include one-to-one models, bring your own device (BYOD) models, cart models, and computer lab models. In *one-to-one models,* students are assigned school-owned personal devices. In *BYOD models,* students use their personally owned devices. In *cart models,* devices are stored on carts and shared by multiple classrooms. In *computer lab models,* non-mobile computing devices are in a central location for shared use.

Key Finding 2: Over time, deployment strategies shifted from shared devices to near-universal use of one-to-one models. Whereas computer labs were once the only viable model, advances in mobile computing—combined with federal guidance encouraging schools to provide more access to technology for all students—led to a shift toward cart models and, when districts had sufficient resources, one-to-one models. The rapid onset of remote learning during the COVID-19 pandemic led to an influx of emergency funding to schools that supported a huge shift to one-to-one models, which remain the most prevalent model today.

Key Finding 3: Current funding challenges are prompting some districts to move away from one-to-one models, suggesting BYOD, cart, and lab models may make a resurgence. As federal funding intended to provide relief during the COVID-19 pandemic dries up, many districts are being forced to consider moving away from one-to-one models and the costs they incur for device replacements, maintenance, and infrastructure.

Key Finding 4: Decades of research make clear that simply giving students access to devices is not sufficient for the devices to support stronger learning, showing the device deployment model is only one consideration influencing how technology initiatives might shape teaching and learning. High quality teacher professional development and institutional capacities around administrative leadership, broadband internet availability, and information technology (IT) staffing also play important roles in making device deployments successful.

Key Finding 5: Early adopters of artificial intelligence (AI) are mostly dabbling with isolated AI initiatives, rather than approaching AI integration in a systematic way that is connected to broader instructional goals. These isolated initiatives have early evidence of learning benefits. However, their lack of connection to broader goals threatens their sustainability. Without stronger leadership and planning, benefits may remain limited and disconnected from conversations about district-wide device deployment decisions.

Key Finding 6: Examples of districts who are integrating AI in relation to broader goals show that AI can be used to help address ongoing challenges in education. For example, some early adopter districts are using AI to improve data-based decision making about instruction, while others are using AI to manage personalized learning at scale.

Key Finding 7: There is not a single device deployment model best positioned to support districts in using AI to improve teaching and learning. Rather, all models have potential use cases for AI that can support broader goals. As districts face upcoming decisions about both device deployment and AI, they will benefit from considering both sets of decisions in relation to their broader goals, the necessary professional development required, and changes that may be required to increase institutional capacities.

The rapid expansion of digital learning in K–12 education, accelerated by the COVID-19 pandemic and the rise of artificial intelligence (AI), has brought renewed attention to **device deployment models**, which education systems use to facilitate student access to and use of digital devices. Device deployment models can play a key role in shaping instructional possibilities, especially in Grades 3–12, where digital tools and AI-powered platforms are increasingly central to teaching and learning (U.S. Office of Educational Technology, 2024; Holmes et al., 2019). As AI becomes more embedded in educational practice, the structure and sustainability of device access will play a critical role in determining how effectively schools can leverage these technologies.

This whitepaper examines issues and successes related to different device deployment models and their implications for teaching and learning, with particular attention to the proliferation of AI tools. The first section describes typical and emerging device deployment models. The second section traces how device deployment models have changed over time and discusses the factors shaping those changes. The third section spotlights key issues related to teacher professional development and institutional capacity—two areas that are critical to successfully using technology in instruction, regardless of the device deployment model. The paper concludes with an examination of how early-adopter school systems are using AI for educational purposes and how the affordances and constraints of various device deployment models could shape AI's impact on teachers' and students' educational experiences.

1. What Are Typical Device Deployment Models in K-12 Education?

This section describes the benefits and challenges associated with four typical device deployment models: one-to-one models, bring your own device (BYOD) models, cart models, and computer or technology lab models. It also discusses examples of emerging hybrid models that blend components of different models.

1.1 One-to-One Models

The most prominent approach in K–12 schools is a one-to-one device deployment model, where each student is assigned a device for their exclusive personal use. One-to-one models include two distinct strategies: take-home models and stay-at-school models.

1.1.1. Take-Home Models

In take-home models, each student is assigned a device—typically a Chromebook, laptop, or tablet—for use both at school and at home. This model supports continuous learning and helps bridge the gap between classroom instruction and homework or enrichment activities conducted outside of school hours. It is particularly beneficial for students who lack access to technology at home, helping to close the “homework gap” (Chandra et al., 2020, p. 5). Take-home one-to-one models provide the most consistent device access to students and enable anytime, anywhere learning with technology, including AI-driven personalized instruction, which adapts to individual student needs and learning trajectories (Sharma et al., 2025).

However, take-home models also present significant challenges. Teachers often bear the burden of managing device readiness as students may forget to charge or bring their devices to school (Massac, 2023). Additionally, parental concerns about screen time and responsibility for device damage can complicate implementation. Schools using take-home models also face increased maintenance demands due to the wear and tear that occurs as students carry devices back and forth (PowerGistics, n.d.).

EXAMPLE: TAKE-HOME ONE-TO-ONE MODEL

Auburn School Department in Maine offers a compelling example of adaptation within a take-home model. After initially deploying MacBook Airs, the district transitioned to iPads which were less costly and offered greater durability. The iPads, bundled with AppleCare+ warranties, were easier to maintain and were more compatible with educational applications. Moreover, the district was able to resell devices after 4–5 years and support students to help with device maintenance, leading to further cost savings (Gilban-Cohen, 2025).

1.1.2. Stay-at-School Models

Stay-at-school models assign individual devices to students but keep them on campus. This approach helps to ensure that devices are always charged and available for instruction, as well as reducing the risk of damage or loss. Stay-at-school models also simplify maintenance and management as schools can centralize charging stations and technical support (PowerGistics, n.d.).

While the stay-at-school model offers logistical advantages, it limits students’ ability to engage in digital homework or out-of-school learning. For students without home internet or devices, this restricts access to technology-powered learning tools outside of the classroom (U.S. Office of Educational Technology, 2024).

EXAMPLE: STAY-AT-SCHOOL ONE-TO-ONE MODEL

McFarland School District in Wisconsin primarily uses a stay-at-school model for iPads in Grades K–5. Students are individually assigned devices, which they keep for the year but do not take home daily. Teachers have discretion to allow students to take devices home for special projects, but parents are required to supervise students' use of the devices in common areas of their homes. The stay-at-school approach minimizes any maintenance issues that may arise from students carrying devices to and from school (McFarland School District, n.d.).

1.2 Bring Your Own Device Models

BYOD models allow students to use personal laptops, tablets, or mobile phones in school. This approach can reduce costs for districts and leverage students' familiarity with their own devices. It also supports continuity between home and school as students can use the same tools across settings (McLean, 2016).

However, BYOD models raise significant concerns about providing high-quality learning experiences for all students. Students from under-resourced backgrounds may lack access to suitable devices, exacerbating the digital divide (United Nations Educational, Scientific and Cultural Organization [UNESCO], 2025). Additionally, managing a diverse array of devices with varying operating systems and security protocols can be complex for school information technology (IT) departments (Poggi, 2023).

EXAMPLE: BYOD MODEL

Fairfax County Public Schools exemplifies an adaptive BYOD strategy. While students are encouraged to bring personal devices, the district supplements access through lending programs and computer labs to ensure that all students can participate fully in digital learning (Fairfax County Public Schools, n.d.).

1.3 Cart Models

In these models, devices (typically Chromebooks or tablets) are stored on carts and shared among classrooms. The mobility of the carts allows for flexible scheduling and supports schools that cannot provide one-to-one devices to facilitate device sharing among students. A cart model provides all students access to a device for at least some of their classroom experiences.

Cart models also have disadvantages, however. The need to schedule access to the carts may limit spontaneous use of devices because students do not have consistent access. Additionally, use of carts can reduce instructional time due to setup and transport logistics. Depending on the number of devices on a cart, students may also have to share devices even when a cart is in their classroom.

EXAMPLE: CART MODEL

Although cart models are currently uncommon, they were used more when devices were first becoming a necessity in classrooms. For example, Visalia Unified School District deployed 10,000 Chromebooks in mobile carts, prioritizing affordability and ease of maintenance (Zurier, 2015). While the devices were first purchased to meet state regulations for standardized testing, after deployment the district began using them for daily educational use.

1.4 Computer or Technology Lab Models

Historically, computer labs were the primary mode of digital access in schools. Today, these dedicated rooms can offer centralized management and may be used for specialized instruction, such as coding, 3D printing, or AI experimentation.

However, lab models are less flexible than other models due to their lack of mobility. Labs are also unlikely to be the only means of accessing devices in today's schools. In the 2020-2021 school year, only about 10% of computers for student use in schools were in resource rooms, computer labs, or libraries (Gray & Lewis, 2021). Since then, modes of device access have only increased. (See Section 2 for more information on these shifts.)

EXAMPLE: LAB MODEL

As mentioned in Section 1.2, Fairfax County Public Schools uses computer labs to help overcome potential limitations in access introduced by their use of a BYOD model (Fairfax County Public Schools, n.d.).

1.5 Hybrid and Emerging Models

Recognizing the limitations of any single approach, many districts are exploring hybrid models that combine elements of one-to-one, cart, BYOD, and lab approaches. These models are tailored to local needs and resource constraints, aiming to maximize access while managing costs. For example, as schools moved toward one-to-one models, some experimented with blending BYOD with school-issued devices to ensure universal access (McLean, 2016; Fairfax County Public Schools, n.d.).

EXAMPLE: HYBRID MODEL

A statewide survey in Connecticut showed that several districts in the state are using hybrid models. One district's approach illustrates the potential of hybrid models to differentiate device deployment across age groups: students in Grades K–5 receive Chromebooks via carts, while those in Grades 6–12 are issued devices directly. Another district reported maintaining over 8,000 desktop computers and virtual reality equipment in addition to their one-to-one mobile devices, suggesting some blending of labs with other models (Connecticut Commission for Educational Technology, 2024).

2. How Have Device Deployment Models in K-12 Education Changed Over Time?

Over the past 30 years, **device deployment in K–12 education evolved from computer labs with stand-alone software tools for skill-specific practice to widespread one-to-one device programs that emphasize interactivity, personalization, and collaboration.** This transformation has been driven by technological innovation, federal policy and funding, and the disruptive impact of the COVID-19 pandemic (Massac, 2023; State Educational Technology Directors Association [SETDA], 2025).

Because the COVID-19 pandemic and the resulting rapid shift to remote teaching led to dramatic changes in device deployment models, this section divides the discussion of the K–12 educational technology landscape into a review of models pre- and post-pandemic. Box 1 summarizes previous federal educational technology initiatives that influenced the shift in device deployment models over time.

Box 1. Federal Education Technology Initiatives

The **Student Support and Academic Enrichment grant program** prioritized improving student outcomes by providing a well-rounded education, keeping students safe and healthy, and using technology effectively.

The **National Education Technology Plan** set the national agenda for educational technology, beginning with the first plan released in 1996.

ConnectED set nationwide goals for access to high-speed internet in schools, as well as calling for private-sector involvement in providing high-quality digital content and devices.

The **Office of Educational Technology** brought together schools and districts working on technology innovation through the **Future Ready District Pledge** to support the work of the ConnectED initiative.

2.1 Pre-Pandemic Technology Landscape

The first National Education Technology Plan (NETP) was released in 1996, two years after the Office of Educational Technology was established within the Department of Education. Early iterations of the plan focused primarily on building technological literacy skills among the nation's children. By the mid-2000s, federal guidance had pivoted to focus on the transformative power of technology in education, with an emphasis on providing access to all students. The 2016 NETP focused on moving beyond technology access to articulate a vision for "everywhere, all-the-time learning" in personalized learning environments, supported by connected devices (U.S. Office of Educational Technology, 2017, p. 85).

Parallel to the Department of Education's evolving policy recommendations, technology tools were rapidly advancing. Desktop computers in dedicated computer labs gave way to laptops, and later to tablets and Chromebooks, enabling device mobility. Each technological shift led to changes in device deployment models, from shared labs to mobile carts to one-to-one models.

Despite these advances, one-to-one device access remained uneven before the pandemic and was often restricted to higher income districts. In 2019, only 45% of schools had a computer for every student (Gray & Lewis, 2021) and many one-to-one initiatives were limited by grade level or did not allow devices to be used at home (Evans, 2018). Cost was a major barrier, particularly in low-income communities (Diallo, 2019; U.S. Office of Educational Technology, 2017).

2.2 Post-Pandemic Technology Landscape

> *"I handed in my five-year strategic plan two years ago, and it included one-to-one technology within the five years. We met as a cabinet over spring break and the superintendent looked at me and said, 'Ken, we need to do it now.'" (McNeel, 2020, para. 9)*

Out of necessity, and with the support of federal investments such as the American Rescue Plan (ARP) Elementary and Secondary School Emergency Relief (ESSER) aid package, districts rapidly deployed millions of devices to students' homes as the COVID-19 pandemic shuttered schools, fundamentally shifting the educational landscape and concepts of where, when, and how learning happens (Council of Chief State School Officers, 2024). This infusion of pandemic-era federal funds allowed districts to quickly shift to one-to-one models, provide support for Wi-Fi hotspots, and help previously unconnected families get online (Arundel, 2024; LeFebvre & Master, 2024). Unprecedented school closures due to the pandemic forced districts to pivot to take-home device deployment models and technology-enabled learning overnight, with little preparation, spotlighting the significant digital divide in the United States.

Today, one-to-one programs remain the most consistently used device deployment model in K–12 schools. This is particularly true for the upper grades, with 90% of middle and high school education leaders reporting one-to-one device implementation in their schools in 2022 (Bushweller, 2022). Data from the Connecticut Commission for Educational Technology (2024) highlight the dramatic rise in one-to-one device deployment models: By 2024, the one-to-one ratio in Connecticut was 97% in Grades 3–5, up from 43% in 2017; and 100% in Grades 6–8, up from 58% in 2017. However, while the pandemic helped to significantly narrow the digital divide, gaps in access persist.

2.3 Current Challenges: The End of Federal Emergency ESSER Funding

The federal government initially provided ESSER funds through three federal COVID-19 relief packages. On average, districts received approximately $1,000 per student annually for five years to address pandemic-related learning loss and operational challenges. Many states and districts used these funds to purchase devices and upgrade technology infrastructure to improve access to high-quality digital learning (Council of Chief State School Officers, 2023, 2024). As the devices used to support the rapid shift to remote learning reach the end of their life cycles, districts are facing the end of this federal emergency relief funding (totaling approximately $190 billion). Many districts are not sure where or when new funding will be available (DiNapoli & Wei, 2025; Gilreath, 2025; Merod, 2025), compounding the challenges they already face in budgeting for device life cycles, sustainability, technology support, and professional development (Arundel, 2024; Council of Chief State School Officers, 2024; DiNapoli & Griffith, 2025).

As districts confront difficult decisions on budgets and technology spending (Arundel, 2024; LeNard & Strietelmeirer, 2024; Shoemaker DeMio & James, 2025), many may need to move away from one-to-one device deployment models for all students. For example, one school district in South Carolina entered the 2025–26 school year with a critical shortage of laptops at the middle and high school levels. Parents reported that their children were "told that not only could they not take their laptops home, but the computers had to be shared between several classes" (Jurado, 2025, para. 7), suggesting that parents and students who had been accustomed to a take-home one-to-one model were facing a shift toward a cart model. District leaders noted that the loss of federal funds, coupled with local budget reductions and challenges with device management and loss, had led to the shortage.

Districts are now in a challenging transition period. One-to-one device deployment has become the expectation, but the sustainability of devices poses a major challenge. Infrastructure costs are expected to increase as technology advances and cybersecurity and privacy concerns rise, and many districts are struggling to identify adequate long-term funding options to support one-to-one models and the staff needed to manage increasingly complex systems (Connecticut

Commission for Educational Technology, 2024; Technology Lab, 2025; Torchia, 2023). This funding uncertainty has made it difficult for districts to adequately plan for technology integration, which has implications for how districts implement emerging technologies, including AI (Gilreath, 2025).

3. What Other Factors Affect the Success of Device Deployments?

As device deployment models change and AI tools for teaching and learning continue to proliferate in schools, reflecting on the factors that contribute to successful technology initiatives will be critical to developing policies and practices that harness the potential of devices and AI. **While the device deployment model is one factor in determining the kinds of teaching and learning that are possible with technology, research also makes clear that there are other considerations that transcend the device deployment model.** This section summarizes learnings about two important factors that influence how technology can shape teaching and learning: teacher professional development and institutional capacity.

3.1 Teacher Professional Development

> *"Just providing hardware is easy. Integrating effective software that links to student-learning goals within the curriculum—and training teachers on how to adapt to it—is difficult." (Bryant et al., 2020, p. 5)*

Decades of research demonstrate that effective educational technology integration is characterized by the purposeful use of technology aligned with learning goals, and that using technology to improve student outcomes requires teachers to adopt new pedagogical approaches that differ from their typical practices (Atkinson & Castro, 2008; Borthwick, Foulger, & Graziano, 2020; Hamilton et al., 2016; Wang, 2006). The challenge of preparing teachers to integrate technology effectively is not new. Prior to the COVID-19 pandemic, it was well-documented that preservice teacher preparation programs inadequately addressed educational technology, typically offering one standalone technology course that focused on basic skills (Borthwick, Foulger, & Graziano, 2020; Graziano, 2018; U.S. Department of Education, Office of Educational Technology, 2017; Wang, 2006).

As technology continued to advance rapidly, many teacher preparation programs looked towards 'technology infusion' – embedding technology throughout teacher preparation coursework and clinical experiences to ensure that new teachers understood how to use technology to support learning goals rather than viewing it as a separate skillset (Gronseth et al., 2010; Foulger et al., 2019; Wetzel et al., 2014). However, despite these efforts, teacher preparation lagged behind technology adoption, with most new teachers continuing to report feeling unprepared to effectively integrate technology into instruction or defaulting to using the same familiar teaching methods they used before devices were readily available (Evans, 2018; Margolin et al., 2015; U.S. Office of Educational Technology, 2017). The COVID-19 pandemic exposed and intensified existing gaps in educator capacity and understanding of best practices for personalized learning and supporting diverse learners in remote environments. As lockdowns began to lift, teachers reflected that better preparation in designing technology-rich learning experiences prior to the pandemic would have eased the transition to remote instruction (Trust & Whalen, 2020).

The acceleration of AI adoption in schools presents a similar risk of rapidly advancing technology without the necessary educator preparation to use it in pedagogically sound ways. The 2017 NETP identified the 'digital use divide' in addition to the digital access divide as a significant challenge, noting disparities between students who use technology for active, creative and collaborative purposes and those who consume media passively (U.S. Office of Educational Technology, 2017, 2024). Without intentional preparation and support for teachers to use AI, there is risk of a worsening digital use divide even when device access is widespread.

> – *"Early on in Robert Dickson's tenure as the chief information officer for Wichita Public Schools, he reviewed the district's technology every five years. The pandemic cut that to three years. Then, in late 2022 a little-known company called OpenAI unleashed a flood of almost magical tools that could write papers, draft lesson plans, and solve math problems in seconds." (Boryga, 2025, para. 1)*

In short, reflection on technology rollouts both before and during the pandemic makes clear that teachers need effective pre-service training and ongoing professional development to develop comfort with a range of technology tools – *how* to use them, *when* to use them and *why* to use them (U.S. Office of Educational Technology, 2024; UNESCO, 2025). The increasing presence of AI in classrooms will only further exacerbate professional development needs (U.S Office of Educational Technology, 2023).

3.2 Institutional Capacity

> *"Year over year there has not been improvement in the three IT functions that have the worst staffing levels. The biggest problem continues to be an IT department's inability to provide adequate instructional support around classroom use." (Maylahn, 2025, p. 55)*

Reflection on past technology rollouts also make clear that effective use of educational technology is dependent on supportive leadership and a culture of continuous learning that enables growth in staff capacities (U.S. Office of Educational Technology, 2017). Strong administrative leadership is essential to ensure that teachers get the professional development and support they need. This may include supporting early-adopter teachers to take the lead in developing their pedagogical knowledge around technology and sharing it with others (Stone, 2022).

Effective use of devices and software tools for education also nearly always requires consistent and reliable access to broadband internet, in school and in students' homes (SETDA, 2025). This means that institutional capacity around IT staffing is another critical but often neglected systemic support needed for the effective use of educational technology. Teachers and students need ongoing support to troubleshoot and repair devices (Chandra et al., 2020). Moreover, only one in three districts in 2024 had at least one staff member dedicated to cybersecurity—an area that will be particularly critical as AI use ramps up in schools (Maylahn, 2024). Adjusting budgets to allow for IT staffing and exploring potential partnerships with community organizations that could provide technical support are key strategies for districts to consider as they strive for sustainable educational technology plans (Chandra et al., 2020).

4. What Do Districts Need to Consider as They Make Decisions about AI and Device Deployment?

As more AI tools become available, educators and education advocates are expressing excitement about AI's potential to help to address persistent challenges in education (U.S. Office of Educational Technology, 2023). Two of these persistent challenges are using data effectively and designing instruction that responds to the needs of diverse learners. Both are well-researched as critical components for improving student achievement and learning outcomes (Schildkamp, 2019; Tomlinson et al., 2003) but are difficult and time-consuming to implement at scale. AI may have the potential to address these longstanding challenges. For example, AI tools that generate personalized learning materials, generate differentiated pathways based on learning profiles, and identify students who are struggling could make implementing evidence-based instructional practices and tiered supports more feasible for educators (U.S. Office of Educational Technology, 2023, 2024).

AI tools alone, however, will not solve these persistent challenges in education. AI tools represent a significant opportunity for system-wide change only if they are implemented with attention to key drivers for success: high-quality professional development, strong leadership, and institutional capacity. The history of educational technology initiatives, including the history of device deployments, has long been characterized by pockets of excellence – districts and schools using technology in new and exciting ways to improve teaching and learning – but has often failed to achieve widespread integration (Cuban, 2001; U.S. Office of Educational Technology, 2017, 2024). AI's capacity to support the fundamental work of educators to use data to create engaging and differentiated learning experiences presents one possible pathway to a deeper and more transformative technology integration. Realizing this potential will depend not only on how device deployment models either enable or hinder different AI applications, but also how teachers are prepared to use AI tools and whether institutional capacities are sufficient to support and sustain their use.

This section first examines how districts are currently using AI, highlighting examples from early adopter schools and systems. Next, the section discusses the implications of different device deployment models for two important AI use cases: supporting data-based decision making and enabling personalized learning through instructional design. **While no one device deployment model is best positioned for every potential use of AI, any decisions districts make about device deployment will have implications for how AI is made available to students and how it might be used.** As educational leaders consider changing their device deployment models in the wake of the end of ESSER funding, the question they face is how to strategically align device deployment decisions with learning goals and available resources while advocating for AI tools designed to work effectively across varied contexts.

4.1 Lessons from Early Adopters of AI

> *"Without an intentional shift toward deeper integration, systemic AI adoption may plateau at surface-level efficiencies rather than catalyzing meaningful redesign. AI may just be an add-on to existing routines rather than a lever for rethinking the broader system." (Dusseault et al., 2025, p. 6)*

AI integration in K-12 education is still in its early stages, but patterns are emerging among districts that have moved quickly to adopt AI tools. Common characteristics of these early adopter districts include considerable institutional capacity such as dedicated technology leadership and staff, established visions for the use of technology, supportive school and district leadership, and organizational cultures that support innovation and experimentation (Diliberti et al., 2024; Dusseault et al., 2025; Maylahn, 2024, 2025). Many of these early adopter districts began piloting AI applications during or immediately after the pandemic.

EXAMPLE: EDUCATION LEADERS PLANNING AHEAD FOR AI

Gwinnett County Public Schools in Georgia has taken a systemic approach to AI by embedding it into curriculum and career pathways. The district opened Seckinger High School with an AI-focused program and created K–12 AI literacy standards. Students at Seckinger High School learn to build AI tools to solve real-world problems, while teachers receive training on ethical and effective AI use. The initiative emphasizes preparing all students for an AI-driven economy through hands-on projects and responsible technology practices (Boryga, 2025; Gwinnett County Public Schools, n.d.).

Early-adopter districts and teachers are experimenting with a range of AI applications, from providing instructional support to improving operational efficiency. At the district level, a national landscape scan of early-adopter practices conducted by the Center on Reinventing Public Education (2024) identified four emerging categories of AI adoption in school systems (public districts and charter networks):

- Providing guidance or frameworks for AI use
- Implementing student-centered, teacher-centered, or family-centered AI tools
- Changing systems and structures by providing access to educator professional development on AI, providing student courses on AI, or rewriting student learning standards to reflect attention to AI
- Using AI-enabled back office tools to advance operational efficiency or enhance safety and surveillance

A scan of press coverage of these early-adopter districts highlights some of the specific innovations being developed and implemented, from a customized chatbot developed by a Texas school district to provide administrative support for teachers (McKim, 2023) to AI avatars designed to improve literacy by providing real-time feedback as students read aloud in Cleveland (Rochford, 2023). Some districts are improving data-based decision making practices by implementing AI-powered analytics platforms that can aggregate student data from multiple sources. Other early adopters are using AI tools to generate differentiated materials, provide just-in-time learner feedback, and adapt content and lesson plans for diverse learners.

While early-adopter districts showcase a wide range of strategies for AI integration, **a common theme among 80% of early adopters is that AI initiatives remain opportunistic and disconnected from broader district strategies, endangering their sustainability** (Dusseault et al., 2025). Emerging district plans and goals also focus on improving efficiency within existing systems, paying particular attention to reducing teacher workloads. For example, districts are adopting tools to support teachers in generating lesson plans. While some districts describe these efficiency-focused efforts as a first step toward more significant change, AI integration may not lead to meaningful changes in education without a broader vision (Dusseault et al., 2025).

The remaining 20% of early-adopter districts illustrate AI integration plans that could lead to transformative change if the initiatives are adequately supported. The Center for Reimagining Public Education characterizes these districts as either *system changers* that leverage AI to achieve broader system-level goals (such as enabling new forms of grading or progress tracking), or *reimaginers* that use AI to fundamentally change student learning experiences (Dusseault et al., 2025).

EXAMPLE: CREATING THE INFRASTRUCTURE TO SUPPORT SYSTEM-WIDE CHANGE

Wichita Public Schools created executive-level roles to guide AI integration across subjects. The district focuses on digital literacy and ethical AI use, training teachers to incorporate generative AI tools into lesson planning and student projects. Leaders emphasize adaptability, viewing AI as a permanent fixture in education (Boryga, 2025).

The next two sections explore two strategic uses of AI currently being used in system-changer and reimaginer districts: using AI to support data-based decision making and using AI to support personalized learning. The discussions examine how each use case intersects with device deployment models and the implications for professional development, institutional capacity, and the risk of widening existing achievement and outcome gaps.

4.2 *AI Use Case 1:* Supporting Data-Based Decision Making

Reviewing vast amounts of academic, behavioral, and social-emotional data is a consistent challenge for schools and districts. Traditionally, this process requires significant time and human effort, particularly as many districts rely on multiple sources of data collected at federal, state, and local levels. Educators are increasingly turning to AI tools to support the analysis of these data to make informed decisions about interventions and supports and to monitor student progress (U.S. Office of Educational Technology, 2023). AI systems can connect disconnected information and process large quantities of data to detect patterns that educators might otherwise miss, such as identifying early warning signs that a student is struggling or evaluating instructional interventions in tiered support systems (e.g., Multi-Tiered System of Supports, Positive Behavioral Interventions and Supports). Using AI tools to provide teachers access to rich student data through dashboards or visualizations can support more intentional and efficient data use to drive content adaptations and increased personalization (Bryant et al., 2020; Torchia, 2023; U.S. Office of Educational Technology, 2023; Westrope, 2025).

EXAMPLE: AI FOR DATA-BASED DECISION MAKING

Elma School District in Washington state is using AI to support a systemic shift toward competency-based learning. The district spent 3 years developing an integrated competency tracking database, using AI to match outcomes to competencies and help educators decide on learning activities that would support students' progress toward competency. The superintendent described AI as a "powerful backbone" in the district's efforts to move to competency-based learning (Dusseault et al., 2025, p. 7).

4.2.1 Implications of Device Deployment Models for Using AI for Data-Based Decisions

Device deployment models have implications for the type and quality of data available to AI systems. Districts interested in using AI to support data-based decisions should consider what data they hope to utilize to inform learning as they make decisions about their device deployment models.

One-to-one models used in combination with AI tools can generate continuous data about student work, patterns of engagement, and learning progressions, allowing for deeper analysis of learning and personalized recommendations. One-to-one models can also support on-device AI tools that run locally—an option that can help to protect student privacy. However, such tools require robust infrastructure that may not be feasible for many districts.

Cart, lab, and BYOD models provide less opportunity for personalized learning progressions and data collection, but smaller amounts of student tracking data could also reduce concerns about student privacy. Cloud-based AI tools can provide analytic capabilities with shared or BYOD deployment models, as the tool follows a student across devices. However, districts should be aware that the amount and types of data gathered by these tools can raise significant privacy concerns (UNESCO, 2025; U.S. Office of Educational Technology, 2023).

4.2.2. Professional Development to Support Using AI for Data-based Decisions

Ongoing, high-quality, embedded professional development that addresses how, when, and why to use AI tools is critical when integrating AI analytic tools that are being used to make decisions about students (U.S. Office of Educational Technology, 2017, 2023, 2024). In addition to learning how to use AI analytic tools, professional development should focus on building data literacy capacities, including learning how to interpret AI-generated insights and when to exercise professional judgment over algorithmic recommendations. AI may also introduce new forms of information about students' learning behaviors, such as detecting when students are not making progress on content, even if they feel and appear to be on task (U.S. Office of Educational Technology, 2023). While this information could be a powerful tool for educators, its potential will not be realized if teachers are not supported to learn how to access and interpret the data to make instructional decisions about what will help a student make progress.

> *"…we may want to… be very careful about delegating control over highly consequential decisions... AI technologies must allow teacher monitoring, have protocols to signal a teacher when their judgment is needed, and allow for classroom, school, or district overrides when they disagree with an instructional choice." (U.S. Office of Educational Technology, 2023, p. 31)*

As noted by the U.S. Office of Educational Technology (2023), it is vital to keep humans in the loop when using AI to support data-based decision making, particularly when making decisions that impact a student's trajectory and educational experience. Educators using these tools should understand that AI detects patterns in data but cannot account for the full complexity of a student's circumstances, background, or individual needs. Professional development should also address the tension between trusting AI recommendations and maintaining skepticism. Research shows that people tend to follow automated recommendations even when they are clearly wrong (U.S. Office of Educational Technology, 2023). This suggests that teachers, as well as school and district leaders, will need authentic, ongoing learning opportunities that address the role of professional judgment when working with AI systems.

4.2.3 Institutional Capacity to Support Using AI for Data-based Decisions

The effective use of AI for data-based decision making comes with significant institutional capacity needs. Districts need technical infrastructure to support AI tools and staff expertise to implement and maintain systems. Often, districts are operating with out-of-date systems, making it difficult to integrate AI into individual components and even more challenging to set up systems to connect data across platforms (Dusseault et al., 2025). This limits the ability of AI tools to support educators in integrating data into actionable insights.

Districts will also need clear policies related to AI use and data governance. As almost half of states do not yet have posted guidance for school districts on AI use (TeachAI, n.d.), many districts will be left to develop their own policies without support. Districts that are integrating AI for data-based decision making must establish protocols for what data are collected, how they are stored and protected, who can access the data, and how long data are retained, ensuring compliance with federal student privacy laws (UNESCO, 2025; U.S. Office of Educational Technology, 2023).

Many districts may lack the technical capacity to implement AI that tracks student data. Only one in three districts has at least one full-time employee dedicated to cybersecurity, and only 7% of districts are fully confident that their operational use of AI aligns with cybersecurity best practices (Maylahn, 2025). This creates significant risk as districts adopt AI tools that collect and process sensitive student data.

4.2.4 Algorithmic Bias, Privacy, and Using AI for Data-Based Decisions

> *"If AI adapts by speeding curricular pace for some students and by slowing the pace for other students (based on incomplete data, poor theories, or biased assumptions about learning), achievement gaps could widen." (U.S. Office of Educational Technology, 2023, p. 3)*

While districts have access to massive amounts of data that can support improvement in student outcomes, they often lack the capacity to turn those data into actionable insights for all students. AI-based decision making can alleviate many common data challenges but carries significant risks of perpetuating or amplifying existing disparities. Algorithmic bias is a well-documented concern. AI systems that are trained on data sets that are not representative of all students can result in decisions that disproportionately impact certain groups of students. For example, a review of AI teacher assistant tools by Common Sense Media (2025) highlighted potential risks when relying on AI to generate individualized education plans or make behavior recommendations, noting that recommended interventions varied based on what the AI model inferred about a student's race and gender. Concerns about shrinking budgets and dwindling funding compound these risks. Well-resourced districts may be able to afford sophisticated AI tools with robust privacy protections and bias-mitigation features, but under-resourced districts may be limited to free or basic tools that lack these safeguards.

4.3 *AI Use Case 2:* Personalized Student Learning

Research on learning and development underscores the importance of addressing learner variability. All students can grow, but they progress along different paths and timelines, requiring environments that are responsive to individual strengths and needs (Cantor et al., 2021; Osher et al., 2017, 2020). Personalized learning reflects these principles through student-centered instruction, learner agency, mastery-based progressions, flexible formats, and whole-child support—approaches that have been shown to foster engagement, collaboration, and deeper learning (Barrett et al., 2015; Daviesa et al., 2012; Kariippanon et al., 2019; Pane et al., 2015, 2017). Importantly, personalized learning need not mean individualized learning. Indeed, collaborative learning activities have great potential for giving students the support they need as they work together and potentially play different roles in the collaboration.

Despite strong evidence on its benefits, implementing personalization is challenging. Many teachers report that they want to personalize instruction but face barriers such as time, curriculum, and technology. In one survey, a third of teachers felt that they were not personalizing effectively, and while 60% believed their feedback was individualized, only 44% of students agreed (Bryant et al., 2020).

Emerging AI tools offer new possibilities to overcome these barriers by automating adaptation, providing predictive insights, and supporting flexible, personalized learning at scale. For example, studies of students using AI-powered intelligent tutoring systems show negative results compared with one-on-one teaching but largely positive results when compared with whole-class teaching (Holmes et al., 2019). This suggests that in the right contexts, AI tutors could reduce the burden on teachers to personalize feedback for every student, allowing them to work with students who most need one-on-one teaching support.

EXAMPLE: USING AI TO DESIGN PERSONALIZED LEARNING

ASU Preparatory Academy in Phoenix, Arizona, exemplifies the strategic use of AI to personalize learning. Educators in this charter network embedded AI tools into their system-wide instructional model, focusing on using AI tutors to support students with strong self-regulation skills while teachers focused their efforts on higher need learners. The integration strategy was based on multiple pilots of AI tools in instruction, where educators evaluated the tools' effectiveness and reflected on contexts where they might best be used (Dusseault et al., 2025).

4.3.1 Implications of Device Deployment Models for Using AI for Personalized Learning

Device deployment models will have a significant impact on how educators use AI to support personalized learning. The availability and configuration of technology within the classroom will determine which AI tools are practical and how they can best be implemented in support of learning goals. As districts consider changing their device deployment models, understanding each model's relative benefits and drawbacks will be essential for aligning AI use cases with instructional goals and ensuring access to high-quality learning experiences for all students.

One-to-one models enable the use of AI tools for independent tasks such as researching, writing, and practicing skills. One-to-one models support AI applications that depend on continuous access, such as adaptive learning platforms that adjust to a student's pace and learning needs. These tools can provide opportunities for personalized instruction by building student profiles, tracking progress over time, and providing just-in-time feedback. For students with disabilities, one-to-one access could ensure consistent availability of AI-powered assistive technologies. One-to-one models can also be used with collaborative AI tools for group projects.

In ***cart models and technology lab models,*** where students do not have consistent access to devices, AI tools designed for group work are especially valuable. Students may collaborate with an AI system that helps to facilitate group discussions, provides feedback on group projects, and provides resources based on the group's needs, personalizing the learning of the group if not each individual student. In these situations, AI can build on the value of collaborative learning by enhancing students' opportunities to learn from each other, even if the AI tools are only available during structured technology time.

In cases where cart or lab models have fewer devices than students, students can collaboratively engage with AI systems on shared devices to solve problems, analyze data, evaluate AI-generated content, or create projects. Using AI tools in collaborative activities supports peer learning and gives students real-world experience of tasks that are essential for their future work and civic engagement, such as evaluating AI outputs, building critical thinking, and engaging in collective sense-making of data and information. Educators could also choose to have some students engage with AI tools on the limited devices while other students get more individualized attention from teachers.

Specialized computer lab models allow districts to provide access to more computationally intensive AI applications for specific learning objectives. Districts could reserve specialized labs for AI tools used for tasks such as 3D modeling; video editing; advanced simulations for science, technology, engineering, and mathematics topics; complex data analysis; or design projects. Specialized labs also create opportunities for students to work with professional AI tools, preparing them for postsecondary education and careers through authentic learning experiences using AI applications in a variety of fields. Such tools would be prohibitively expensive for most districts to deploy universally in a one-to-one model, but specialized lab models may allow districts to have more (and more sophisticated) AI tools available on a limited number of devices with sufficient computing power. The availability of these tools could support students to personalize their own learning paths by choosing to explore projects and career fields that are meaningful to them.

Hybrid models offer educators the most pedagogical flexibility, supporting the alignment of device access and AI tools with specific learning goals. In a hybrid model, students might use individual devices to access AI-supported writing feedback and adaptive practice; access specialized labs for computationally intensive AI applications; and use shared cart devices for collaborative, AI-enhanced, project-based learning. Rather than aligning all learning experiences with a single deployment model, hybrid approaches could enable teachers to make intentional decisions about *when* and *how* to integrate specific AI tools in service of specific learning objectives.

4.3.2. Professional Development to Support Using AI for Personalized Learning

Improving student learning outcomes requires more than just access to AI tools. Teachers who are integrating AI into their practice must have the time, training, and hands-on experience to use AI tools effectively. Districts should prioritize professional learning that focuses on *when* and *how* to use AI tools to achieve learning goals, in addition to training on the technical features of AI tools. These professional development experiences will support teachers to effectively use AI to personalize learning, taking into account when and how often AI tools are available to students in their schools' device deployment model. In a recent survey, about half of teachers reported that their professional development was not grounded in students' needs or learning goals (Gallup & Walton Family Foundation, 2025). This suggests that professional development for AI integration should be designed to address the reality of teaching and learning.

Effective professional development for AI integration should focus on helping teachers understand how to use AI as a partner in instructional design, while maintaining their pedagogical expertise and professional judgment. Teachers will need to learn how to critically evaluate AI-generated feedback and recommendations and identify when they may be inappropriate or biased (U.S. Office of Educational Technology, 2023). Districts should also ensure that teachers have a voice in selecting which AI tools are adopted. Bryant and colleagues (2020, p. 7) note that “teachers should have the freedom to pilot alternatives, and they should have a strong voice in deciding which tools are working in the classroom and should roll out districtwide.”

EXAMPLE: DESIGNING AUTHENTIC AI PROFESSIONAL DEVELOPMENT CONNECTED TO TEACHING AND LEARNING

Hancock Place School District in Missouri prioritized professional development as part of its AI rollout. After a year of research and expert consultation, leaders selected three tools that aligned with curriculum goals. District leaders organized mandatory, hands-on summer workshops and required that teachers leave the training with a specific, actionable use case for AI that elevated student learning and aligned with curriculum goals (Boryga, 2025).

4.3.3. Institutional Capacity to Support Using AI for Personalized Learning

Integrating AI into instructional design and delivery requires careful planning and intentionality from district leaders. This includes meeting institutional capacity needs, which go beyond simply providing access to AI tools. As noted in Section 4.3.2, teachers need dedicated time to learn how to use new tools, experiment with using AI to design instruction, and collaborate with colleagues about effective practices.

Districts will also need to invest in infrastructure that supports the use of AI tools for instruction. Generative AI uses continuous data exchange, and adaptive learning and personalization features require reliable internet connectivity. Within the current funding landscape, many districts may face difficult decisions about whether to invest in upgrading and maintaining devices or improving network infrastructure. Additionally, many AI tools operate on subscription-based models, which can add further costs for districts that are already struggling with device costs for purchases and repairs, understaffed IT departments, and cybersecurity threats (Maylahn, 2025). Budget limitations may restrict access to more advanced AI capabilities, such as adaptive learning platforms or personalized tutoring systems.

4.3.4 Limitations of AI for Addressing Learner Variability

While AI tools show promise for personalizing learning to meet the needs of all students, AI integration runs the risk of amplifying existing disparities between schools and districts. Well-resourced schools may have access to premium AI tools that generate high-quality adapted materials, as well as feedback and guidance that address learner variability and support personalization. In contrast, under-resourced schools may be limited to free or low-cost tools that are less sophisticated, produce more generic adapted materials, or offer fewer features for personalization.

Research on the science of learning and development emphasizes the importance of personalization and attending to the variability inherent in all learners (Cantor et al., 2021; Osher et al., 2017, 2020). The U.S. Office of Educational Technology (2023, p. 46) notes that when used effectively, AI tools can "bring opportunities to address a wider spectrum of strengths and needs but only if developers and innovators focus on the long tail and not only 'teaching to the middle.'" AI tools should be designed from the beginning to address the needs of varied learners—including students with disabilities and culturally and linguistically diverse learners—to ensure that all students benefit from high-quality personalized instruction.

EXAMPLE: USING AI TO HELP ADDRESS ACHIEVEMENT GAPS

Central Square School District in New York is using AI as a key strategy to close post-pandemic achievement gaps. Teachers are using AI to plan lessons aligned to state standards while differentiating instruction for a variety of learning needs. AI-powered tools assist in creating individualized learning paths, including accommodations for students with disabilities and those with Individualized Education Programs (IEPs) to ensure that all students can make meaningful academic progress (Braun-Silva, 2025).

5. Conclusion

AI is advancing rapidly and is already beginning to reshape the K–12 educational landscape. As AI becomes more deeply embedded in K–12 education in the United States, device deployment models—whether one-to-one, cart, BYOD, lab, or hybrid models—must be evaluated not only for their instructional potential but also for their implications in terms of cost, safety, privacy, and infrastructure. These factors are increasingly central to deployment decisions, especially as AI amplifies both opportunities and risks for teaching and learning (UNESCO, 2025; U.S. Department of Education, 2023). Districts are simultaneously contending with financial pressures and aging hardware which will also influence deployment decisions, forcing many to consider moving away from one-to-one models.

One-to-one models do offer some advantages in how AI can be used. For example, they make it possible for all students to consistently receive individualized feedback and support from adaptive tutors, which has shown promise for supporting learning (Holmes et al., 2019). However, individual students interacting with AI is not the only way in which AI can transform education. As some districts move away from universal one-to-one models toward hybrid approaches that may include shared devices or carts, there is an opportunity to advocate for AI tools that support different pedagogical purposes, including addressing persistent challenges with using data to guide instruction and personalizing learning. Rather than forcing learning goals to conform to available technology, districts and educators can strategically select differentiated AI tools matched to different deployment models and specific teaching and learning goals.

The AI use case examples outlined in Section 4 highlight that successful AI integration depends on more than tool selection and device deployment. Several themes emerge that will be critical for districts to attend to as they navigate device deployment decisions and AI adoption. These cross-cutting considerations – maintaining educator professional judgement, ensuring student privacy, and building sustainable infrastructure – will determine whether AI integration is successful at addressing longstanding educational challenges and improving outcomes for students.

The Critical Role of Educator Professional Judgment. In both current and future potential use cases for AI in education, keeping humans in the loop is essential. AI applications should augment educator expertise, not replace it. Teachers must be able to monitor (and override, where necessary) decisions about student needs, intervention strategies, and instructional approaches. However, districts should be thoughtful about implementing systems of checks and balances. As the U.S. Office of Educational Technology (2023, p. 31) notes, “We cannot forget that if a technology allows a teacher choice—which it should—it will take significant time for a teacher to think through and set up all the options.” Asking teachers to review and approve every AI-generated recommendation could create more work and add to teacher burden.

Privacy, Security, and Ethical Considerations. Implementing AI to support personalized learning and data-based decision making relies on collecting and processing significant amounts of student data. Districts need clear policies on data collection, storage, access, retention, and deletion. Policies must ensure compliance with student privacy laws and address new concerns raised by AI when it comes to educational records and student safety.

Infrastructure and Sustainability. Regardless of the device deployment model used, integrating AI tools requires reliable connectivity, adequate bandwidth, secure data storage, and devices capable of running AI applications. Districts that are facing budget constraints must make strategic decisions about where to invest limited resources. The subscription-based pricing model of many AI tools creates ongoing costs that compound existing budget pressures.

AI tools for learning are becoming more sophisticated, and districts are exploring their use through various device deployment models. This is creating a growing need for research examining learning outcomes, particularly for traditionally underserved students, students with disabilities, and English language learners. As districts pilot tools and gather evidence of effectiveness, sharing results with the broader education community will be of vital importance to help the field move toward transformative uses of AI and technology.

References

Arundel, K. (2024, September 30). *With ESSER expiration, COVID-19 spending prepares for finale*. K–12 Dive. https://www.k12dive.com/news/school-funding-esser-American-Rescue-Plan-covid-19-coronavirus/728352/

Atkinson, R. D., & Castro, D. (2008). *Digital quality of life: Understanding the personal and social benefits of the information technology revolution*. The Information Technology and Innovation Foundation.

Barrett, P., Davies, F., Zhang, Y., & Barrett, L. (2015). The impact of classroom design on pupils' learning: Final results of a holistic, multi-level analysis. *Building and Environment*, *89*, 118–133.

Borthwick, A. C., Foulger, T. S., & Graziano, K. J. (2020). Champions as water carriers: Prioritizing technology infusion in teacher preparation. *Championing technology infusion in teacher preparation: A framework for supporting future educators*, xxii-xxxiii.

Boryga, A. (2025, November 7). *How forward-thinking schools are shaping the future of AI in education*. Edutopia. https://www.edutopia.org/article/how-forward-thinking-schools-are-shaping-the-future-of-ai-in-education

Braun-Silva, B. (2025, August 20). *School districts take mixed approach to AI as federal government signals support*. GMA. https://abcnews.go.com/GMA/Living/school-districts-approach-to-ai/story?id=124783860

Bryant, J., Heitz, C., Sanghvi, S., & Wagle, D. (2020, January 14). *How artificial intelligence will impact K–12 teachers*. McKinsey & Company. https://www.mckinsey.com/industries/public-and-social-sector/our-insights/how-artificial-intelligence-will-impact-k-12-teachers

Bushweller, K. (2022, May 17). What the massive shift to 1-to-1 computing means for schools, in charts. *Education Week*. https://www.edweek.org/technology/what-the-massive-shift-to-1-to-1-computing-means-for-schools-in-charts/2022/05

Cantor, P., Osher, D., Berg, J., Steyer, L., & Rose, T. (2021). Malleability, plasticity, and individuality: How children learn and develop in context. In P. Cantor & D. Osher (Eds.), *The science of learning and development* (pp. 3–54). Routledge.

Center on Reinventing Public Education. (2024, May 29). *Districts and AI: Tracking early adopters and implications for the 2024–25 school year*. https://crpe.org/districts-and-ai-tracking-early-adopters-and-what-this-means-for-2024-25/

Chandra, S., Fazlullah, A., Hill, H., Lynch, J., McBride, L., Weiss, D., & Wu, M. (2020). *Connect all students: How states and school districts can close the digital divide*. Common Sense Media.

Common Sense Media. (2025, August 6). *AI risk assessment: AI teacher assistants*. https://www.commonsensemedia.org/ai-ratings/ai-teacher-assistants

Connecticut Commission for Educational Technology. (2024, November 26). *2024 K–12 technology staffing and devices: Results from survey of K–12 technology leaders*. https://portal.ct.gov/das/-/media/das/ctedtech/publications/2024/cet2024k12staffdevices.pdf

Council of Chief State School Officers. (2024). *States leading: How state education agencies leveraged pandemic relief funds*. https://learning.ccsso.org/states-leading-how-state-education-agencies-are-leveraging-the-esser-set-aside

Council of Chief State School Officers. (2023). *The road to recovery: How states are using federal relief funds to strengthen and expand high-quality digital learning*. https://learning.ccsso.org/how-states-are-using-federal-relief-funds-to-strengthen-and-expand-high-quality-digital-learning

Cuban, L. (2001). *Oversold and underused: Computers in the classroom*. Harvard University Press.

Daviesa, D., Jindal-Snapeb, D., Collier, C., Digbya, R., Haya, P., & Howea, A. (2012). *Creative learning environments in education—A systematic literature review.* Centre for Research in Early Scientific Learning.

Diallo, A. (2019, April 22). *School districts are going into debt to keep up with technology*. The Hechinger Report. https://hechingerreport.org/school-districts-are-going-into-debt-to-keep-up-with-technology/

Diliberti, M. K., Schwartz, H. L., Doan, S., Shapiro, A., Rainey, L. R., & Lake, R. J. (2024). *Using artificial intelligence tools in K–12 classrooms* (Research Report No. RR-A956-21). RAND Corporation. https://www.rand.org/pubs/research_reports/RRA956-21.html

DiNapoli, M. A. Jr., & Griffith, M. (2025, June 30). *States face uncertainty as an estimated $6.2 billion in K–12 funding remains unreleased: Here's the fiscal impact by state*. Learning Policy Institute. https://learningpolicyinstitute.org/blog/states-face-uncertainty-k-12-funding-remains-unreleased

DiNapoli, M. A. Jr., & Wei, W. (2025, August 26). *$5 billion in federal funding for nine K–12 formula grant programs hangs in the balance between White House and Senate proposals*. Learning Policy Institute. https://learningpolicyinstitute.org/blog/5-billion-federal-k-12-formula-funding-hangs-balance-between-white-house-and-senate-proposals

Dusseault, B., Simis, M., & Berardino, M. (2025). *AI early adopter districts: The promises and challenges of using AI to transform education.* Center for Reinventing Public Education. https://crpe.org/ai-early-adopter-districts-the-promises-and-challenges-of-using-ai-to-transform-education/

Evans, J. A. (2018). *Beyond engagement: Using technology to enable new learning experiences and empower educational effectiveness* (Briefing Paper). Project Tomorrow.

Fairfax County Public Schools. (n.d.). *Bring your own device (BYOD): Encouraging respectful collaboration in the technology era*. https://www.fcps.edu/services/technology/technology-programs/bring-your-own-device-byod

Gallup, Inc., & Walton Family Foundation. (2025). *Teaching for tomorrow: How supporting teachers today shapes classrooms tomorrow*. https://www.gallup.com/analytics/659819/k-12-teacher-research.aspx

Gilban-Cohen, J. (2025, August 21). *Schools turn to tablets, student help to sustain 1:1 programs*. Government Technology. https://www.govtech.com/education/k-12/schools-turn-to-tablets-student-help-to-sustain-1-1-programs

Gilreath, A. (2025, September 18). *Schools confront a new reality: They can't count on federal money*. The Hechinger Report. https://hechingerreport.org/schools-confront-a-new-reality-they-cant-count-on-federal-money/

Gray, L., & Lewis, L. (2021). *Use of educational technology for instruction in public schools: 2019–20 first look—summary* (NCES 2021-017). U.S. Department of Education, National Center for Education Statistics.

Graziano, K. J. (2018). Preservice teachers' comfort levels with technology in an online standalone educational technology course. *Journal of Teaching and Learning with Technology*, *7*(1), 70-86.

Gronseth, S., Brush, T., Ottenbreit-Leftwich, A., Strycker, J., Abaci, S., Easterling, W., ... & Leusen, P. V. (2010). Equipping the next generation of teachers: Technology preparation and practice. *Journal of Digital Learning in Teacher Education*, *27*(1), 30-36.

Gwinnett County Public Schools (n.d.). *Artificial intelligence and computer science.* https://www.gcpsk12.org/programs-and-services/college-and-career-development/academies-and-career-technical-and-agricultural-education/artificial-intelligence-and-computer-science

Hamilton, E. R., Rosenberg, J. M., & Akcaoglu, M. (2016). The Substitution Augmentation Modification Redefinition (SAMR) Model: A critical review and suggestions for its use. *Tech Trends*, *60*, 433–441. http://dx.doi.org/10.1007/s11528-016-0091-y

Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial intelligence in education promises and implications for teaching and learning*. Center for Curriculum Redesign.

Jurado, A. (2025, August 29). *Laptop shortage impacts South Carolina school district*. Government Technology. https://www.govtech.com/education/k-12/laptop-shortage-impacts-south-carolina-school-district

Kariippanon, K. E., Cliff, D. P., Lancaster, S. J., Okely, A. D., & Parrish, A. M. (2019). Flexible learning spaces facilitate interaction, collaboration and behavioural engagement in secondary school. *PloS one*, *14*(10), e0223607.

LeFebvre, J., & Master, S. (2024, February 28). *Expiration of federal K–12 emergency funds could pose challenges for states*. Center on Budget and Policy Priorities. https://www.cbpp.org/research/state-budget-and-tax/expiration-of-federal-k-12-emergency-funds-could-pose-challenges-for

LeNard, D., & Strietelmeier, C. (2024, September 12). What to know about how less funding might affect K–12 this school year. *EdTech Magazine*. https://edtechmagazine.com/k12/article/2024/09/what-know-about-how-less-funding-might-affect-k-12-school-year

Margolin, J., Heppen, J., Haynes, E., Ruedel, K., Meakin, J., Rickles, J., Samkian, A., O'Brien, B., Surr, W., & Fellers, L. (2015). *Evaluation of LAUSD's Instructional Technology Initiative: Year 2 report*. American Institutes for Research. https://www.air.org/

Massac, M. (2023). *Navigating student device 1:1 sustainability: Challenges and solutions in a post-pandemic landscape*. Consortium for School Networking. https://www.cosn.org/

Maylahn, P. (2024). *2024 state of EdTech district leadership*. Consortium for School Networking. https://www.cosn.org/

Maylahn, P. (2025). *Operational AI in education: A CoSN 2025 member survey—readiness, realities, and the road ahead*. Consortium for School Networking & HPE. https://www.cosn.org/

McFarland School District. (n.d.). *School 1:1 technology program acceptable use agreement*. https://www.mcfarland.k12.wi.us/district/OLR/School%201%20to%201%20agreement.pdf

McKim, D. (2023, August 8). *Llano ISD rolls out customized artificial intelligence tool for teachers*. KXAN News. https://www.kxan.com/news/education/llano-isd-rolls-out-customized-artificial-intelligence-tool-for-teachers/

McLean, K. J. (2016). The implementation of bring your own device (BYOD) in primary [elementary] schools. *Frontiers in Psychology*, *7*, 1739. https://doi.org/10.3389/fpsyg.2016.01739

McNeel, B. (2020, May 18). *Oral history — 5 school leaders, 4 weeks & the biggest education crisis of their careers*. The 74. https://www.the74million.org/article/oral-history-5-school-leaders-4-weeks-the-biggest-education-crisis-of-their-careers/

Merod, A. (2025, September 30). *FCC removes school bus Wi-Fi, hotspots from E-rate*. K–12 Dive. https://www.k12dive.com/news/fcc-removes-school-bus-wi-fi-hotspots-from-e-rate/761481/

Osher, D., Cantor, P., Berg, J., Steyer, L., & Rose, T. (2020). Drivers of human development: How relationships and context shape learning and development. *Applied Developmental Science*, *24*(1), 6–36.

Osher, D., Cantor, P., Berg, J., Steyer, L., Rose, T., & Nolan, E. (2017). *Science of learning and development: A synthesis*. American Institutes for Research.

Pane, J. F., Steiner, E. D., Baird, M. D., & Hamilton, L. S. (2015). *Continued progress: Promising evidence on personalized learning* (Research Report RR-1365-BMGF). RAND Corporation. https://www.rand.org/pubs/research_reports/RR1365.html

Pane, J. F., Steiner, E. D., Baird, M. D., Hamilton, L. S., & Pane, J. D. (2017). *Informing progress: Insights on personalized learning implementation and effects* (Research Report RR-2042-BMGF). RAND Corporation. https://www.rand.org/pubs/research_reports/RR2042.html

Poggi, N. (2023, June 29). *BYOD in schools: the pros and cons*. Prey Project. https://preyproject.com/blog/device-security-in-schools-byod-for-lovers-and-haters

PowerGistics. (n.d.). *A complete guide to technology models for schools*. https://powergistics.com/blog/a-complete-guide-to-technology-models-for-schools/

Rochford, P. (2023, March 22). *AI will soon be commonplace in Cleveland classrooms*. Signal Cleveland. https://signalcleveland.org/ai-will-soon-be-commonplace-in-cleveland-classrooms/

Schildkamp, K. (2019). Data-based decision-making for school improvement: Research insights and gaps. *Educational research*, *61*(3), 257-273.

Sharma, S., Mittal, P., Kumar, M., & Bhardwaj, V. (2025). The role of large language models in personalized learning: A systematic review of educational impact. *Discover Sustainability*, *6*, 243. https://doi.org/10.1007/s43621-025-01094-z

Shoemaker DeMio, P., & James, W. (2025, May 8). *The sudden loss of federal COVID-19 relief funds will hinder K–12 academic progress*. Center for American Progress. https://www.americanprogress.org/article/the-sudden-loss-of-federal-covid-19-relief-funds-will-hinder-k-12-academic-progress/

State Educational Technology Directors Association (SETDA). (2025). *The universal connectivity imperative: Sustaining progress to close the digital access divide in K–12 education.* https://www.setda.org

Stone, A. (2022, October 5). How K–12 schools can overcome common one-to-one device hurdles. *EdTech Magazine*. https://edtechmagazine.com/k12/article/2022/10/how-k-12-schools-can-overcome-common-one-one-device-hurdles

TeachAI. (n.d.). *AI in education: Guidance and policy tracker*. https://www.teachai.org/policy-tracker

Technology Lab. (2025, April 3). *Strategies for navigating IT funding cuts in K–12 schools*. https://www.technologylab.com/strategies-for-navigating-it-funding-cuts-in-k-12-schools/

Tomlinson, C. A., Brighton, C., Hertberg, H., Callahan, C. M., Moon, T. R., Brimijoin, K., ... & Reynolds, T. (2003). Differentiating instruction in response to student readiness, interest, and learning profile in academically diverse classrooms: A review of literature. *Journal for the Education of the Gifted*, *27*(2-3), 119-145.

Torchia, R. (2023, December 20). 5 K–12 ed tech trends to follow in 2024. *EdTech Magazine*. https://edtechmagazine.com/k12/article/2023/12/5-k-12-ed-tech-trends-follow-2024

Trust, T., & Whalen, J. (2020). Should teachers be trained in emergency remote teaching? Lessons learned from the COVID-19 pandemic. *Journal of Technology and Teacher Education, 28*(2), 189–199.

United Nations Educational, Scientific and Cultural Organization (UNESCO). (2025). *AI and education: Protecting the rights of learners*. https://doi.org/10.54675/ROQH4287

U.S. Office of Educational Technology. (2017). *Reimagining the role of technology in education: 2017 National Education Technology Plan update.* U.S. Department of Education.

U.S. Office of Educational Technology. (2023). *Artificial intelligence and the future of teaching and learning: Insights and recommendations*. U.S. Department of Education.

U.S. Office of Educational Technology. (2024). *National Educational Technology Plan: A call to action for closing the digital access, design, and use divides*. U.S. Department of Education.

Wang, Y. M. (2006). Stand-alone computer courses in teachers' IT training. *Educause Quarterly*, *29*(3), 8.

Westrope, A. (2025, January 28). *FETC25: K–12 budgeting for technology in 2025 and beyond.* Government Technology. https://www.govtech.com/education/k-12/fetc25-k-12-budgeting-for-technology-in-2025-and-beyond

Zurier, S. (2015, June 26). Top 5 one-to-one computing devices in schools. *EdTech Magazine*. https://edtechmagazine.com/k12/article/2015/06/5-devices-k-12-one-one-initiatives

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