Generative AI in Educator Preparation and Professional Development: A Strategic Analysis of the Current Landscape, Research Gaps, and Collaborative Opportunities

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Executive Summary

This report provides a comprehensive analysis of the integration of generative artificial intelligence (GenAI) into educator preparation and professional development. With a specific focus on developing leadership skills for managing student interactions, the research synthesizes the current state of adoption, identifies critical research gaps, and outlines strategic opportunities for collaboration. The findings indicate that while GenAI holds transformative potential for education, its integration into teacher training is in its nascent stages, characterized by uneven adoption, significant faculty resistance, and a narrow focus that often prioritizes plagiarism detection over pedagogical innovation.

The landscape of professional development for in-service educators is more dynamic, with universities and organizations offering a range of programs from foundational modules to advanced leadership certificates. However, empirical evidence on the long-term effectiveness of these programs remains scarce. A significant gap exists in the application of GenAl for developing the nuanced, interpersonal leadership skills required for managing complex student interactions. Current Al tools in this domain primarily focus on behavior monitoring and data analytics rather than on formative training and skill development.

Key research gaps identified include the need for longitudinal studies on the impact of GenAl training, effective models for scalable faculty development, and empirical research on integrating Al into clinical placements. Most critically, there is a lack of tools and methodologies for using GenAl to train educators in adaptive leadership.

This report concludes by proposing several strategic opportunities for a collaboration between A4A and the University of Denver Morgridge College of Education. These opportunities include the development of a GenAl-powered simulation for leadership training, the co-design of a research-backed micro-credential in Al for educators, the establishment of a research-practice partnership for faculty development, and a national study on Al in clinical settings. Such initiatives would not only address the identified gaps but also position the partnership at the forefront of preparing educators for an Al-augmented future.

The Current State of Generative AI in Educator Preparation Programs

The advent of powerful, publicly accessible generative AI has created an urgent need for educator preparation programs (EPPs) to adapt their curricula and training models. The next generation of teachers must be equipped to navigate a landscape where AI can be both a powerful pedagogical ally and a source of significant ethical and practical challenges. However, current research indicates that the vast majority of EPPs are struggling to keep pace with the rapid technological advancements, resulting in a significant gap between the needs of future classrooms and the training new teachers receive.

Adoption and Integration: An Infancy Stage

The integration of generative AI into U.S. teacher preparation programs is currently in its infancy and is marked by slow, uneven progress. A landmark 2024 survey of over 500 education school leaders, conducted by the Center on Reinventing Public Education (CRPE), reveals a landscape of cautious and limited engagement. The study found that only 59 percent of responding programs offer any form of AI-related instruction to preservice teachers. Furthermore, this instruction is often narrow in scope, with a predominant focus on using AI detection tools to prevent plagiarism rather than exploring AI's potential to support innovative instructional design. A mere 25 percent of programs reported providing training on how AI can be used to create new ways of teaching. This limited focus is further reflected in institutional policy, or the lack thereof. More than two-thirds of surveyed education schools have no formal policies governing the use of GenAI. Where policies do exist, they overwhelmingly concentrate on academic integrity and the misrepresentation of work, neglecting a broader vision for how AI could transform teaching and learning. This reactive, risk-averse posture suggests that many institutions are not yet prepared to proactively guide future educators in harnessing GenAI as a transformative tool.

Despite this slow start, there is an acknowledgment among many education school leaders of the need to evolve. The CRPE report indicates that approximately 80 percent of surveyed programs plan to expand their Al-related offerings in the future. However, a concerning minority—nearly one in five—have no plans to enhance their Al instruction at all, signaling a potential for the gap to widen between proactive and stagnant institutions. The overall sentiment captured by one administrator, who stated, "We're very much in the infancy stage of understanding what Al means for K-12 education and for higher ed," encapsulates the current state of the field. Without a significant strategic shift, EPPs risk producing graduates who are underprepared for the realities of the modern, Al-integrated classroom.

Faculty Capacity and Resistance: A Primary Bottleneck

A primary barrier to the effective integration of GenAl into teacher preparation is the limited capacity and prevalent apprehension among faculty. For preservice teachers to become competent and confident users of Al, their instructors must first possess the necessary skills and pedagogical vision. The CRPE survey paints a stark picture of this challenge: only 10 percent of education school leaders reported that their faculty feel confident using Al in their instruction. Conversely, more than half of leaders indicated that their faculty have little to no confidence in integrating Al tools into their teaching practices. This lack of confidence is a significant impediment, as it directly impacts the quality and depth of Al-related training that preservice teachers receive.

This faculty resistance stems from a combination of factors, including legitimate ethical concerns and a simple lack of familiarity with the technology. Leaders reported that faculty often view AI primarily as a "cheating tool," a perception that reinforces the narrow focus on plagiarism detection. Deeper anxieties are also at play, including fears about data privacy, the security of intellectual property, and the existential threat of AI replacing human educators. One dean noted that some faculty are "paranoid," believing that AI will literally replace them in their jobs. This apprehension is compounded by a lack of institutional support. Most EPPs have not sought external expertise to build internal capacity; only about one-third have formed partnerships or brought in technical experts to support faculty or student learning. As a result, even faculty who are curious about AI often find themselves "in the weeds," struggling to understand its capabilities and how to adapt the technology for their own classrooms. This finding is corroborated by other studies, such as one by Bae et al. (2024), which found that even after exposure to AI, only a minority of preservice teachers and teacher-educators planned to adopt the tools, citing lingering uncertainties and emotional barriers.

Emerging Models and Conceptual Frameworks

While the overall picture is one of lagging adoption, a handful of institutions and researchers are pioneering more forward-thinking approaches. These exemplars provide a potential roadmap for other EPPs seeking to bridge the AI training gap. For instance, Arizona State University's Mary Lou Fulton Teachers College has proactively engaged faculty through voluntary, cross-departmental working groups and has established a university-wide partnership with OpenAI to explore the technology's implications. This strategy aims to build a broad base of understanding by creating opportunities for faculty from diverse disciplines to experiment with AI tools. Similarly, the University of Northern Iowa has convened stakeholders from across its campus and local school districts to develop resources, culminating in the creation of a new "AI for Educators" graduate certificate. These initiatives demonstrate the importance of institutional leadership and collaborative, community-based approaches to building capacity.

In parallel with these institutional efforts, researchers are developing conceptual frameworks for meaningfully integrating GenAl into teacher training. Blonder et al. (2024) propose a novel

application of GenAI to uncover and develop preservice science teachers' pedagogical content knowledge (PCK). Their conceptual paper suggests that by engaging in interactive dialogues with a GenAI tool during lesson planning, preservice teachers can reveal their understanding of content and pedagogy, allowing for personalized feedback and targeted program adjustments. This approach reframes AI from a simple productivity tool to a diagnostic and developmental partner. Similarly, a study by Wen & Wen (2024) examined how preservice teachers used ChatGPT to design literacy unit plans. Their findings underscore that while AI can support planning tasks, it cannot replace professional judgment. This highlights the critical need for EPPs to move beyond basic tool use and prepare future teachers in sophisticated prompt design and the critical evaluation of AI-generated outputs, a skill set that aligns with the Technological Pedagogical Content Knowledge (TPACK) framework. These emerging models and frameworks signal a necessary shift from a focus on AI literacy as a technical skill to a more holistic approach centered on critical, ethical, and pedagogical fluency.

The Professional Development Landscape for In-Service Educators and Leaders

While EPPs are slowly adapting, the professional development (PD) landscape for current K-12 educators and leaders is more dynamic, with a growing array of programs designed to build Al competency. These offerings range from free, self-paced introductory modules to intensive, graduate-level certificate programs, catering to different roles, budgets, and learning needs. This burgeoning market reflects a clear demand from in-service educators for practical training that can be immediately applied in their schools and classrooms.

Formal Certificate Programs and University Offerings

Several universities are establishing themselves as leaders in advanced AI training for educators, offering structured, cohort-based certificate programs. The University of California, Irvine (UCI) School of Education offers an online "AI in Education Certificate Program" designed for K-12 teachers, coaches, and leaders. This three-course program aims to develop AI literacy, establish ethical frameworks, and guide participants in creating classroom-ready AI projects, with a key outcome being the ability to lead AI-related conversations at the school and district levels. Similarly, the University of San Diego (USD) offers an "Advanced Certificate in AI Integration for Educational Leadership" through its continuing education division. This hybrid program targets principals, curriculum directors, and staff developers, focusing on integrating AI into administrative workflows, designing AI-enhanced learning experiences aligned with Universal Design for Learning (UDL), and crafting school-wide AI adoption plans.

For leaders seeking a more executive-level focus, Stanford Online provides a six-week course titled "Al-Driven Leadership: Strategies for the Future." Offered by the School of Engineering, this program emphasizes generative Al management, predictive analytics, and strategic planning for organizational Al adoption. While not exclusively for educators, its focus on Al-driven decision-making and operational efficiency is highly relevant to educational leaders

managing complex systems. These university-based programs are characterized by their academic rigor, cohort-based models that foster collaboration, and the awarding of formal credentials such as certificates and continuing education units or graduate-level credits. They represent a significant investment in time and tuition, targeting educators who are poised to become institutional leaders in AI integration.

Scalable and Accessible Training Initiatives

Contrasting with the intensive university certificate programs are more accessible and scalable initiatives designed to reach a broader audience of educators. A major development in this area is the American Federation of Teachers (AFT) "National Academy for AI Instruction," launched in fall 2025. Funded by a \$23 million, five-year investment from Microsoft, OpenAI, and Anthropic, this initiative aims to train 400,000 of its members. The academy, with a physical hub in Manhattan and plans for national scaling, offers free workshops, online courses, and hands-on sessions focused on AI ethics, curriculum integration, and tool refinement. This union-backed model represents a powerful effort to democratize AI training and empower teachers to be active participants in the development and deployment of educational AI tools.

At the most accessible end of the spectrum is the Microsoft Educator Center's "Al for Educators" training path. This free, self-directed learning program on the Microsoft Learn platform consists of four modules covering the fundamentals of Al, large language models, prompt engineering, and responsible use. Aligned with UNESCO and ISTE standards, it focuses on practical applications using Microsoft's suite of tools, such as Copilot and Teams. This model is ideal for classroom teachers and school leaders seeking a low-stakes, foundational introduction to Al. Another example of accessible, targeted training is the one-day live online institute offered by the Bureau of Education & Research (BER). For a fee, this workshop provides practical strategies for grades 6-12 leaders on integrating Al for personalized learning, workload reduction, and classroom management, with the option to earn graduate credits. These scalable models, from the union-led academy to free online modules, are crucial for building baseline Al literacy across the entire education workforce.

Measured Effectiveness of Professional Development

Despite the proliferation of Al-focused professional development programs, rigorous empirical evidence of their effectiveness is still emerging. However, early studies provide promising insights into what constitutes impactful training. A quasi-experimental study conducted in China with 215 preservice teachers (Lu et al., 2024) found that a group receiving GenAl-assisted teaching skills training demonstrated statistically significant gains in both self-efficacy and higher-order thinking compared to a control group receiving traditional training. Qualitative feedback from the experimental group further revealed increased confidence in lesson planning and differentiating instruction, suggesting that hands-on, integrated Al training can produce measurable improvements in key teacher competencies.

Other research highlights the importance of sustained support beyond initial training. A study of a one-day PD webinar for educators in Ghana (Nyaaba & Zhai, 2024) found that while the session successfully broadened awareness of AI tools and generated a high intent to integrate them, participants identified significant barriers to implementation, including infrastructure constraints and ethical concerns. This suggests that one-off workshops, while useful for building initial enthusiasm, are insufficient to drive lasting practice change without ongoing institutional support, such as access to premium tools and scaffolded workshops. Further synthesizing the literature, a review by Brandão et al. (2024) analyzed 33 studies to identify the core components of effective AI professional development. The review concluded that successful programs consistently include four key elements: foundational AI literacy, hands-on tool exploration, explicit instruction on ethical frameworks, and strategies for pedagogical integration. Together, these studies indicate that effective PD must be practical, sustained, and holistic, moving beyond tool demonstration to foster deep pedagogical and ethical reasoning.

Generative AI for Leadership in Managing Student Interactions

A critical and underdeveloped area within AI for education is its application in preparing leaders to manage complex and sensitive student interactions. While many existing AI tools focus on tracking behavior or monitoring digital activity, there is a significant opportunity to leverage generative AI for the formative development of the sophisticated interpersonal skills that define effective educational leadership.

Current Al Tools for Classroom and Behavior Management

The current market of Al-powered tools for the classroom largely centers on managing student behavior, engagement, and safety, rather than on developing educator skills. These platforms function primarily as monitoring and analytics systems. For example, tools like ClassDojo and Kickboard use Al-driven dashboards to help teachers log and identify trends in student behavior, streamlining the data collection process for systems like Positive Behavioral Interventions and Supports (PBIS). Other platforms, such as Hero and BehaviorFlip, offer more comprehensive monitoring, logging incidents across various school environments and using predictive analytics to flag at-risk students for proactive support.

A second category of tools focuses on student engagement and dialogue. Curipod uses AI to generate interactive presentation elements like polls and word clouds, providing real-time analysis of student participation to help teachers adjust instruction on the fly. TeachFX takes a different approach by recording and analyzing classroom conversations to provide teachers with data on the balance of teacher-talk versus student-talk and the use of effective questioning techniques. This tool promotes self-reflection to help educators create more student-centered dialogue.

A third category prioritizes student safety in digital environments. GoGuardian Beacon and Gaggle Safety Management use AI to scan student web activity and digital communications for

indicators of bullying, self-harm, or other risks, sending real-time alerts to school staff. While these tools are invaluable for intervention and safeguarding, their function is reactive monitoring. The common thread across all these platforms is their focus on providing in-service teachers and administrators with data for in-the-moment management and intervention. They are tools for *doing* the work, not for *learning* how to do the work.

The Missing Link: Generative AI for Developing Adaptive Leadership Skills

The most significant gap in the current landscape is the lack of generative AI applications designed specifically to train educators and leaders in the art of managing human interactions. The existing tools can quantify behavior or analyze talk time, but they do not provide a safe, simulated environment for a preservice principal to practice a difficult conversation with a parent, for a new teacher to learn de-escalation techniques with a disruptive student, or for an instructional coach to rehearse providing critical feedback to a veteran teacher. This is where the unique capabilities of generative AI present a transformative opportunity.

Drawing inspiration from the conceptual work of Blonder et al. (2024), who proposed using GenAl dialogues to develop pedagogical content knowledge, a similar model could be created for leadership and adaptive skills. Imagine a GenAl-powered simulation where an aspiring school leader is presented with a scenario—for instance, a student has been accused of cyberbullying. The user would need to engage in a text- or voice-based dialogue with Al-powered personas representing the student, the target of the bullying, and their parents. The Al could be programmed to respond with realistic emotions, defensiveness, and concerns, challenging the user to apply principles of restorative justice, active listening, and clear communication. After the simulation, the Al could provide a detailed analysis of the user's performance, highlighting moments of effective communication, identifying missed opportunities, and suggesting alternative phrasing or approaches. Such a tool would move beyond data analytics to provide active, formative practice in the complex, high-stakes interpersonal work that is central to educational leadership. This represents a critical and underexplored frontier for GenAl in educator preparation.

Overarching Ethical Considerations

The integration of AI into educator preparation and professional practice is inseparable from a complex web of ethical considerations. As EPPs and school districts begin to adopt these powerful tools, they must concurrently develop robust ethical frameworks to guide their use, ensuring that AI serves to enhance, not undermine, human-centered teaching and learning. The guidance provided by bodies like the Georgia Professional Standards Commission (GaPSC) offers a valuable blueprint for navigating this terrain.

Policy, Governance, and Professional Judgment

A foundational ethical requirement is the establishment of clear policies and governance structures. The GaPSC guidance emphasizes that districts and EPPs should adopt a core set of principles—such as human-centered use, fairness, transparency, and accountability—and develop an approved list of sanctioned AI tools. This prevents a chaotic and unvetted proliferation of applications within schools. Critically, these policies must reinforce the principle that AI is a tool to augment, not replace, the professional judgment of an educator. All AI-generated outputs used for significant decisions regarding student assessment, placement, or discipline must be reviewed and validated by a qualified human. Furthermore, educators must model transparency, clearly communicating to students and families when and how AI is used in instruction. This dual focus on establishing clear institutional guardrails while preserving individual professional agency is paramount for responsible implementation.

Data Privacy, Bias, and Equity

Two of the most pressing ethical challenges are safeguarding student data and mitigating algorithmic bias. EPPs must train future educators to be vigilant protectors of personally identifiable information (PII), teaching them to avoid entering sensitive student data into public AI platforms and to scrutinize the data privacy policies of any educational technology vendor. Institutions have a responsibility to ensure any adopted AI tools are compliant with federal and state privacy laws like FERPA and COPPA. Alongside privacy, equity must be a central concern. AI models are trained on vast datasets that can reflect and amplify existing societal biases. Therefore, training programs must equip educators with the skills to critically evaluate AI outputs for biased, exclusionary, or stereotypical content. They must also address the "digital divide," ensuring that disparities in student access to AI tools do not exacerbate existing educational inequities. This involves both selecting vendors who are transparent about their bias-mitigation methods and fostering classroom practices that ensure fair and equitable use for all students.

Analysis of Research Gaps and Opportunities for Collaboration

The preceding analysis reveals a field in transition, rich with potential but fraught with challenges. For organizations like A4A and the University of Denver Morgridge College of Education, this landscape presents a unique opportunity to lead through strategic research and development. By targeting the most significant gaps in knowledge and practice, a focused collaboration can accelerate the responsible and effective integration of AI in education.

Identified Research Gaps

A thorough review of the current literature and programmatic offerings reveals several critical research gaps that must be addressed to move the field forward.

First, there is a significant gap between conceptual frameworks and empirical evidence in preservice training. While scholars propose innovative uses for GenAl in developing pedagogical knowledge, there is a dearth of rigorous, empirical studies demonstrating how to effectively embed these practices into EPP curricula at scale. The CRPE report confirms that most programs have not moved beyond a surface-level, defensive posture, leaving a wide-open field for research on effective models of integration.

Second, the existing effectiveness studies are predominantly short-term. Research is needed to understand the longitudinal impact of Al-focused professional development. We do not yet know if the gains in self-efficacy or higher-order thinking observed in short-term interventions translate into sustained changes in classroom practice and, ultimately, improved student learning outcomes over time.

Third, and most central to this report's focus, is the profound gap in leadership development for adaptive skills. There is a clear disconnect between the current market of AI tools for monitoring student behavior and the potential of generative AI to serve as a training and simulation platform for developing the nuanced, interpersonal skills essential for leadership. Research is needed to design, build, and test such simulation tools and to measure their impact on the preparedness of new teachers and administrators.

Finally, the challenge of faculty capacity remains a critical bottleneck. The CRPE report highlights widespread faculty resistance and lack of confidence. This points to a need for research on effective, scalable, and sustainable models of faculty development. Simply offering one-off workshops is insufficient. Research should explore cohort-based models, communities of practice, and other strategies to build lasting institutional capacity within EPPs.

Strategic Opportunities for A4A and University of Denver Collaboration

These identified gaps map directly onto strategic opportunities for a partnership between A4A and the University of Denver Morgridge College of Education. By leveraging their combined expertise in educational research, practice, and technology, they can pioneer solutions that address the field's most pressing needs.

A primary opportunity lies in developing and piloting a **GenAl-Powered Leadership Simulation Tool**. Addressing the most significant identified gap, this project would involve creating a sophisticated simulation environment where preservice and in-service educators can practice managing difficult conversations related to student behavior, academic integrity, and parent communication. A research component would rigorously evaluate the tool's effectiveness in improving the confidence and competence of educational leaders, providing a groundbreaking model for the field.

A second opportunity is to **co-design and research an "Al for Educators" micro-credential or certificate program**. Building on the models offered by other universities, a DU-A4A

program could distinguish itself by focusing specifically on ethical leadership, pedagogical innovation, and the use of AI for equity. The program would be a living laboratory, with an embedded longitudinal research study tracking the impact on participants' practice and their students' outcomes, thereby addressing the gap in long-term effectiveness studies.

A third strategic initiative would be to **establish a Research-Practice Partnership for Faculty Development**. To tackle the critical barrier of faculty resistance, the collaboration could create and lead a consortium of EPPs dedicated to developing and testing effective faculty training models. This would involve creating shared curricular resources, facilitating a national community of practice, and researching which approaches are most effective for building confidence and competence among teacher-educators.

Finally, the partnership could **conduct a national survey focused on the use of AI in clinical placements and residencies**. This research would extend the work of the CRPE report by drilling down into the critical, under-researched context of student teaching. Understanding how, or if, AI is being integrated where theory meets practice would provide invaluable data to guide EPP curriculum reform and policy development nationwide.

Conclusion

The integration of generative AI into education is at a critical inflection point. While the challenges of adoption are significant, the potential to enhance teacher effectiveness and student learning is immense. The current landscape is defined by a gap between the rapid evolution of technology and the slow pace of institutional adaptation, particularly within educator preparation programs. For the next generation of educators to be prepared for the classrooms of tomorrow, a concerted and strategic effort is required from researchers, practitioners, and policymakers.

The research gaps—in empirical evidence, longitudinal impact, leadership training, and faculty development—are not insurmountable obstacles but rather clear invitations for innovation. A strategic collaboration between A4A and the University of Denver Morgridge College of Education is uniquely positioned to answer this call. By focusing on high-impact initiatives such as developing leadership simulations, creating research-backed credentialing programs, and building networks for faculty development, the partnership can not only contribute vital knowledge to the field but also actively shape a future where AI is harnessed ethically, equitably, and effectively to support the human work of teaching and learning.

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